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1883	"	63	" "	1890	"	289	" "
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Electric Quacks. A RECENT visitor to the Electrical Building at the World's Fair informs us that he found the "universal electric-eye-cure" exhibitor wearing dark blue glasses, that the "electric-invigorator" man was sick in bed with nervous debility, the "electric cure all" inventor had recently died quite suddenly, the "electric-rejuvenator" exhibitor appeared to be in his second childhood, and that the "hair-invigorator" attendant was as bald as an egg. At their stands he was told they were too busy selling their goods to attend to themselves; a good business for these dull times.

The Magnetic Qualities of Iron. AN important point in dynamo design is to know the magnetic quality of the iron proposed to be used. Of scarcely less importance is a means to test different samples of iron after a design has entered the manufacturing stage, not only to determine if a new purchase departs materially from the standard adopted, but to enable experiments to be made on other brands with a view to improvement. We give elsewhere a paper read by Mr. A. E. Kennelly before the International Electrical Congress, in which is described an improved form of an instrument for the measurement of magnetic reluctance, which seems at last to offer a practical and reliable means for the determination of the magnetic quality of iron for the purposes referred to. If the iron to be tested is always a bar of the same dimensions it will be seen that a simple comparison of the number of soft iron strips necessary to add to the standard side of the instrument will determine the comparative quality of the sample, calculations thus being avoided.

The Storage Battery Decision. THE decision handed down recently by Judge Colt in the suit of the Brush Electric Company against the Milford & Hopedale Street Railway again sustains the broad claims of the Brush storage battery patent on the mechanical application of active material to a suitable support. With their contention now firmly established and the Faure patent on the use of active material in the form of a paste, paint or cement expired, it only requires a liberal policy on the part of the victors to give a great impetus to the storage battery industry. The present licensees under the Brush patents have always professed a considerate policy for those whom the courts have declared infringers of their patents. With the field apparently now clear of litigation they are in a position to treat with the owners of patents on different forms of storage cells, which, in the absence of an arrangement permitting them to apply active material, cannot be manufactured, notwithstanding any intrinsic merit they may possess. No branch of electrical industry has perhaps suffered so much from litigation as that relating to storage batteries, and it is to be sincerely hoped that the end of this unfortunate condition of affairs has been at last reached.

The Telephone in Great Britain. AT the beginning of last year the British Parliament authorized the government purchase of telephone trunk lines, and it is known that the postal authorities are strongly in favor of taking over all the telephone business and placing it on a basis similar to that of the present state administration of telegraphs. In this, however, it is probable that much opposition will be met with, not only from the commercial interests involved, but also from municipalities desirous of owning and operating local telephone lines in the same manner that many at present control the supply of water, gas and the electric light. The struggle will be regarded with interest in the United States, whether the views of the state or of the municipalities prevail, particularly as illustrating the development of the socialistic principle in municipal bodies, which in recent years has been taking such a strong hold in Great Britain, and elsewhere to a less extent. There is little doubt but that the question of state or municipal ownership of means of communication and the supply of gas and the electric light will become more and more prominent everywhere. On account of the admirable system of municipal government that prevails in Great Britain, that country is peculiarly fitted to undertake the trial of these municipal experiments, but, unless our city governments cease to be the centres of political corruption they now are, we will have little opportunity to profit should the result be ever so successful. This is particularly true of a municipal telephone service, as it would be out of the question to attempt to transact confidential business through an exchange in control of one of our typical political city "organizations" and officered by its heelers.

A Field for Inventors. WITH the present type of alternating current motors the speed can only be varied, it appears, within a limit not exceeding 10 per cent. without a great sacrifice of efficiency and modification of the torque. This, of course, makes this class of motors unsuitable for use where the speed has greatly to be varied or where different speeds are required for considerable lengths of time. The most important use thus affected is that for street railways, where ordinarily a motor is used comparatively little at what would be its most efficient speed. In mining work, as in running a pumps, motor must be capable of being used efficiently at widely varying speeds, so that this class of work forms another important exception, and doubtless others will occur to the reader. In this connection, we may state that one of the great mining companies of the United States, after thorough investigation in this country and in Europe, decided against the use of the alternating system for the reasons given above. Whether it is possible to design an alternating current motor of any system that will be able to compete with the continuous current motor in the respect referred to, is questionable in the present state of the art; but the great prize in store for the successful inventor will doubtless stimulate investigation, and may lead to the accomplishment of the desired result. It is only fair to state that the cause of this defect of the alternating current motor is also the cause of the admirable regulation of such motors, which, in one system at least, maintains the speed within two per cent. between no load and full load.

More About Mr. Martin's Case. IN this issue we lay before our readers the second installment of the report of Mr. Martin's lawsuit and begin the story of what may be called his second attempt to establish his case. The report last week showed how and where he stopped, as he supposed for good and for all; but a week or so after he stopped found him in the contest again, brought face to face with the necessity of making new exertions, and resorting to some further expedients, all of which were doomed to prove unavailing. We remarked in our report last week that Mr. Martin, although given ample opportunity to do so, never disclosed to us what reasons he had for his curious quarrel with THE ELECTRICAL WORLD. It will be noticed from our report in this week's issue that when he went on the stand all he saw fit to tell under the guidance of his own counsel can be recorded in about one column of space. It seems rather odd that of the incidents of this dispute which, one would naturally suppose, had impressed themselves firmly on Mr. Martin's mind, many of the most striking appear to have proved so light as to have made little or no impression on him whatever. They must have passed from his memory without leaving any recollection, pleasant or otherwise, else during his examination he would not have been so often under the necessity of replying to questions put to him: "I cannot recollect," "I do not remember." He was compelled to resort to this answer in regard to several important matters. We have read in works on the mind that we forget easiest such things, events and conversations as do not at the time they occur interest us, and which it is not likely, judging from what we then know, we shall ever have any need to recall. Mr. Martin had so many of the incidents vitally connected with his troubles effaced so completely from his memory that we must suppose that at the time they occurred he regarded them as of little or no consequence and as something he never expected to need to recall, or else happily they made no unpleasant or harsh impression upon him, such as we are told is the least forgotten the harder we try to forget. When he entirely pinned his faith on that ill omened letter of June 7—not expecting to be called upon to produce anything else—he unfortunately relied upon something which proved even more disastrous to him than it did to the man who wrote it.

Polyphased Currents. CONSIDERABLE misconception seems to prevail in regard to the character of polyphased (or multiphase) currents, and this undoubtedly arises from the practice of calling a simple alternating current a single phase current, and speaking of polyphased currents in the singular. A simple alternating current may be said to have an infinite number of phases, as each point in the periodic curve by which it is represented marks a phase. The proper use of the term as applied to several periodic curves is to designate the angular distance between corresponding points in the respective curves. In a two-phase system, for example, there are two currents which differ 90 degrees in phase; that is, in a clock diagram the vectors sweeping the two curves are separated by an angle of 90 degrees. In a three-phase system there are three currents which may be represented by curves whose vectors in a clock diagram are separated by 120 degrees. Another point on which there seems to be misconception is in regard to the generation and distribution of polyphased currents. Two-phase and three-phase generators are in principle two or three combined simple alternators, and polyphased currents could be generated by rigidly coupling together two or three simple alternators in such a manner that the angle between similar points of corresponding coils is equal to the angle of phase. In other words, the two or three systems of windings of a polyphased generator each independently generates a simple alternating current. In the two-phase system the two currents are entirely distinct in the two working circuits, but are united in the third circuit until at the machine, where they are again separated. For convenience, the third or larger wire of a two-phase system may be regarded as similar to a common return in a continuous current system; its size, however, is only $\sqrt{2}$ times, instead of twice, as large as either of the other two wires owing to the difference in phase decreasing the value of the resultant current. In the three-phase system each line may be considered to be alternately a leading wire for one circuit and a return wire for one or both of the other circuits. Prof. Forbes stated at the Chicago Congress that two phase currents can be generated cheaper than simple alternating currents, and as a consequence there would be this saving, with an additional one in copper, through the use of two-phase machines; an application of this would be to have trunk lines and feeders consist of three wires, branching out into four wires for general distribution. From what has been said it will be seen that this system would in effect be a simple alternating one with merely two of the wires united in the trunk lines or feeders, and have the advantage of a considerable saving of copper.

The Underwriters' International Electric Association.

The Underwriters' International Electric Association has printed the report of its Electrical Committee, which has been adopted, giving the recent amendments to the insurance rules adopted this spring, definitions of the word "approved" as used in these rules, recommendations as to the approval of certain wires and materials, rules recommended in relation to automatic fire systems, and resolutions relating to methods of house wiring, ground return wires, and the American Institute of Architects.

Most of the amendments to the rules are for the purpose of giving greater definiteness to the same, and none of them introduces any notable change.

The thickness and character of the insulation of wire that will be approved is specified, and definitions given to guide the inspector wherever the word "approve" appears in the rules. A number of other definitions and explanatory sections are given to aid in the interpretation of the rules, and a list of non-combustible, non-absorptive insulating materials and of commercial wires added that comply with the requirements.

A set of rules has been reported by the committee for the installation of automatic and municipal fire alarm systems which specifies how thermostats must be placed and wired, and what alarm gongs and annunciators shall be used, and minor points provided for.

A resolution was adopted calling attention to the practice of closing in house wiring so that it is inaccessible for inspection, and strongly recommending the use of wireways that will render concealed wiring permanently accessible. In furtherance of this the secretary is requested to communicate with the American Institute of Architects and ask their co-operation in an endeavor to have architects, when drawing up plans, make provision for the channeling and pocketing of buildings for electric light and power wires, and that they also be requested, in specifications for electric gas-light wiring, to require a two-wire circuit, whether the building is to be wired for electric lighting or not, and that no part of the gas fixtures or gas piping be allowed to be used for the gas lighting circuit.

The attention of the various boards of underwriters, electricians and others interested is called to the matter of the possible effect upon metallic substances, especially water mains, buried in the ground, from electrolysis, caused by the ground return of single trolley street railway systems, on account of the danger of water mains giving way through this corrosion at a time when extra protection is needed for fire department purposes.

In accordance with a vote of the committee, Mr. W. H. Merrill, Jr., electrician of the Chicago Fire Underwriters' Association, was added to the committee, and the subject matter was divided and assigned to different members as follows:

Enforcement of Rules and Financial Support of the Association, Mr. Bliven.

Central Stations and Isolated Plants, Mr. McDevitt.

High Potential Systems, Mr. Leloup.

Low Potential, Outside Wiring and Exposed Inside Wiring, Wiring of Special Hazards, and Motors, Mr. Van Geisen.

Low Potential Inside Wiring, Concealed and in Wireways, Mr. Low.

Electric Railroads and Storage Batteries, Mr. Fitzgerald.

Automatic Fire Alarms and Inspection and Policy Forms, Mr. Merrill.

Testing and Approval of Devices and Material, Mr. Cabot.

Alternating Systems, Arc Lighting on Low Potential Systems, Electric Gas Lighting, Heating Devices, Municipal Fire Alarms, and the Press, Mr. Goddard.

Laboratory Notes.—V.*

BY LIEUT. F. JARVIS PATTEN.

It is now, doubtless, plain why I have passed from single alternating current to triphase currents without any particular reference to the procuring of "biphase" currents, or two currents in quadrature. The reason is that, to obtain these currents from a motor dynamo requires four auxiliary rings, which is more than can be placed upon any ordinary collector and leave room for the motor brushes. So this method is not regarded as a practical one for obtaining biphase currents, while various other methods of getting them will be shown later on. In general terms, then, single phase alternating and triphase alternating currents are the only derivations that can be had in a simple way directly from a constant potential direct current through the agency of a motor-dynamo without any material change in the mechanical structure of the machine. It will not be overlooked, however, that if four rings can be placed anywhere upon the armature spindle and connected to points of the armature winding (or collector segments) at the opposite extremities of two diameters at right angles to each other, then such rings will deliver two currents in quadrature or biphase alternating currents to four leads connected to brushes bearing on the rings.

You are now prepared to sketch a general plan of the principal or initial circuits of a laboratory system. Such a plan is shown in Fig. 3. The collector of the motor-dynamo has three rings connected for triphase currents. The 110-volt house circuit is connected to the machine brushes through a starting box or variable resistance Rh_1, which, for convenience, had better not be placed at the machine, but on a table near the apparatus

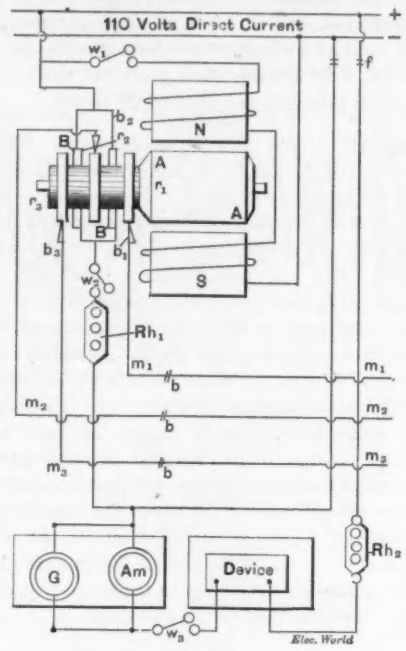

Fig. 3.

to be experimented with, so that it will be under immediate control at all times.

The field circuit of the machine will be independently connected through the switch w_1. From the auxiliary ring brushes b_1, b_2, b_3 leads m_1, m_2, m_3 are taken to a convenient place for experimental use of the current.

If a single alternating current is required the inner and outer rings are properly adjusted on the collector and the two outside leads m_1, m_3 are used, care being taken to disconnect the middle lead. If triphase currents are required all three leads and rings are used. It is quite necessary to have a firm table near to the devices with which you are experimenting for the measuring instruments, ammeter, voltmeter, galvanometer and resistance box. The table for instruments should, however, be apart from all other devices, as free from vibration as possible, and on account of the magnetic action of some instruments they should be placed as far as possible from dynamos or motors, the strong fields of which would disturb their action.

An adjustable rheostat Rh_2, which will be later referred to in detail, will necesarily be placed in every experimental circuit to control the terminal voltage and the amount of current allowed in the circuit, the limiting amount being always determined by a fuse plug which will melt and open the circuit if by any accident or chance mistake an excess of current should be permitted to flow.

With such a system of circuits as that shown in Fig. 3 you have quite a wide range at your command for experimental work. Thus, to recapitulate, you have at hand constant potential direct current of 0 to 110 volts and 0 to 30 amperes, which can be had in the form of electric current from the mains or in the form of mechanical power by causing it to drive the motor. Or it may be transformed to single alternating or triphase alternating currents, and in those forms altered to a different voltage and current strength.

The triphase currents will give the rotary field effect by which many interesting investigations can be made that are not to be arrived at in any other way, and the single alternating current is available for its countless applications.

A word concerning the frequency of the alternating currents thus derived will be appropriate. By the term "commercial frequency" I shall indicate those frequencies commonly used on lighting circuits from 110 to 140 complete periods a second in this country and as low as 80 in European practice for lighting, and down to 40 a second for motor work and power distribution by alternating currents. Anything below this will be refered to as "low frequency," and any rate very much higher than the highest commercial frequency will be characterized as "high frequency currents." The motor-dynamo described will, of course, give one complete period to each revolution; its speed is, therefore, an expression for the frequency of the transformed alternating currents it delivers. At a speed of 1,800 we have a frequency, therefore, of 30 complete periods, or 60 reversals, a second—a rather low frequency. A higher frequency requires, of course, a higher speed of a multipolar machine. It will be difficult, however, on this plan to get more than 60 or 80 periods from any form of direct current machine, six poles being the highest number generally used, and this, driven at 1,200, nearly double its normal speed, would give but 60 complete periods a second, still a little below the lowest commercial frequency. To complete an arbitrary classification of current frequencies, I shall designate by the name "currents of high potential and high frequency" those of enormously high periods, such as those obtained by means of the disruptive arc discharge and used in the well known Tesla effects.

If an alternating current of ordinary commercial frequency, say, 240 reversals a second, is required, then of course the simplest and the cheapest plan is to put in a transformer that draws its supply from the alternating current mains of the street, if such there be at hand; but if a place has been selected where direct current is obtainable in this way, the alternating circuit will not generally be found in the immediate neighborhood, and must, therefore, be generated independently or derived in some way from the direct current, as before explained.

There is, however, one quite serious objection to the commercial alternating current as a prime mover or source of energy for the laboratory—its frequency remains practically constant, and cannot be changed if desired. This may often prove a serious drawback, for in most cases where experiments are made upon apparatus requiring these currents, the results will depend in a large measure upon the frequency of the current used, and it becomes, therefore, most important to have a current the rate of alternation of which can be varied at will.

The independent alternate current dynamo, driven by a direct current motor or other mechanical power, will answer most purposes, unless a much higher frequency than that in ordinary use is required.

A small alternator having a crown of, say, twelve poles and giving that number of reversals per revolution can be made to give a considerable range of frequency by simply using different speeds or different sized pulleys for driving if a prime mover of constant speed is used. In this way a speed of from 10 to 40 revolutions a second is easily obtainable, giving frequencies varying from 120 to 480 reversals a second, or from about one-half to double the rate of the usual lighting circuits. For testing apparatus pertaining to lighting systems, transformers, lamps, motors and the like, this range of frequency will answer most purposes.

If such a machine is used its field will, of course, be separately excited by direct current, and this circuit should have a rheostat for changing the field excitation—decreasing the latter as the speed is increased, so as to maintain a nearly fixed E. M. F. at the brushes of the alternator through different changes of speed and frequency.

It will be found, however, that for general laboratory work quite a variety of currents differing in form, as well in the rate of reversal or interruption, will be required, and as the problem of obtaining currents of high frequency by mechanical means is becoming daily more important, some devices for accomplishing this will be referred to in connection with this general subject of obtaining reversed and alternating currents from the direct current by means of the motor-dynamo. That currents making as high as 4,000 to 6,000 reversals a second can be obtained from a machine of the two-pole Gramme ring type by suitably connecting the armature winding to the collector may not be generally known to those who desire to experiment with such currents.

(To be continued.)

Judging the Electrical Exhibits at the World's Fair.—IV.

BY HERMANN S. HERING.

X.—Directly-coupled Engines and Dynamos.

After persistent and untiring efforts on the part of the judges, the many difficulties that have arisen in connection with the preparation for the tests of the large machines and threatened for a time their discontinuance have at last been successfully overcome, and these most important tests are now in progress, having begun on Wednesday, Sept. 20.

The machines that are being tested are a Westinghouse and a General Electric power generator, a Westinghouse alternating-current and a General Electric direct-current lighting generator. These are standard commercial machines of the latest type, and are the size and style that will be extensively used in central stations, and the result of these tests will therefore be awaited with great interest.

Following is a brief description of the machine:

(a) The General Electric Company's power generator, driven by a Lake Erie engine, Fig. 1, is located at the power house of the Intramural Railway, and supplies power for railway and other purposes. It is of the ten-pole type with an ironclad armature with a rated output of 750 kw. at 600 volts. The engine is a vertical triple expansion marine, either condensing or non-condensing, of 1,000 h. p. The high and low pressure cylinders are 22 inches and 44 inches in diameter, respectively, with a 36-inch stroke. Positively driven flat, two-faced valves, four ported, self-adjusting to their seats, are used. The high pressure steam valve is under direct control of a shaft governor. The boiler pressure is 125 pounds, and the speed 100 revolutions per minute.

(b) The Westinghouse power generator is driven by a Reynolds-Corliss engine, and is located in the south-

*Continued from The Electrical World of Sept. 30, 1893.

eastern part of Machinery Hall. It is a horizontal, cross-compound type, with cylinders 19 inches and 36 inches diameter and a 48-inch stroke. It runs at about 96 revolutions per minute, and is rated at 500 h. p. The pressure used generally at Machinery Hall is 120 pounds, but this engine is designed for 150 pounds, and will run at that pressure during the test.

The generator, which is for direct current, is of the six-pole type, with circular frame and drum armature. It is compound wound, has a rated capacity of 600 kw. at 500 volts, and furnishes power on several parts of the grounds for various purposes. Although the engine has a smaller rated capacity (500 h. p.) the makers claim that they can run the generator to its full capacity (750 h. p.) without straining the engine.

The generator is placed between the cranks of the low and high pressure engines.

(c) The General Electric Company's direct-current lighting generator is driven by the large Edison engine, Fig. 2, and is located in the southeast corner of Machinery Hall. The engine is one of the triple compound, vertical marine type machines which the General Electric Company has been lately introducing. It has a Corliss valve gear; the cylinders are 22½, 33⅛ and 53⅜ inches in diameter, and it has a 36-inch stroke. The speed is 100 revolutions per minute, and the engine is rated at 1,200 h. p. under 150 pounds of steam. Two 400-kw., direct current generators are connected to it, one at each end, and run at 150 volts, and are used for service on the Edison three-wire system. These generators have 12 poles, are shunt wound and have Gramme ring armatures, with the commutator forming one side of the ring.

(d) The Westinghouse alternating-current lighting generator is directly connected to a Westinghouse, Church, Kerr & Co. engine, and is one of the six 1,000-h. p. units that are used for lighting the grounds and buildings. The engine is a vertical, compound condensing engine, rated at 1,000 h. p., runs at 210 revolutions per minute, and should have 160 pounds of steam, but only 125 pounds is allowed by the authorities at present. Its cylinders are 21 and 37 inches in diameter, and it has a 22-inch stroke. The generator is of the usual type made by this company; it has 36 poles, and runs at 2,000 volts with 120 alternations, and is rated at a maximum output of 15,000 16-c. p. lamps.

The Siemens & Halske company has withdrawn its machines from the tests.

The tests are to be essentially for the purpose of ascertaining the consumption of steam and the electrical and commercial efficiencies of the apparatus under various loads, and to aid the jury in forming an estimate of the value of the exhibits.

The economy of the Westinghouse, Church, Kerr & Co. engine will not be determined, owing to the fact that these engines were hastily constructed to supply an immediate demand, and are merely temporary types.

No fuel tests will be made with any of the boilers, although each engine is independently connected to a boiler.

From a preliminary report issued by sub-committee 3, which committee will conduct these tests, the following extracts are taken, as practically no changes have been made in the original draft:

General Description of Tests.—There are to be three classes of tests of each apparatus, to be designated A, B and C.

"A" Tests.—Not less than one or more than three complete tests are to be made with each apparatus to ascertain the economy in the use of steam and the relation of the indicated horse power to the electrical output. One of such tests to be made with a load corresponding substantially with the maximum efficiency, one near the minimum allowable load and one near the maximum allowable load.

"B" Tests.—Partial tests, supplementary to the above, without measuring the water evaporated, but varying the load by gradual increments through the practicable range, to be made for comparing the indicated horse power with the electrical output.

"C" Tests.—These tests are designed to aid in distributing the energy developed in the engine in excess of that shown by the total output in watts, to include friction tests of engine and a determination of the resistance caused by exciting the field with the main circuit open; they include also tests of electrical resistance, heating of armature, field, etc.

Order of Tests.—The apparatus to be first opened at substantially six-tenths of its maximum load for at least four hours before commencing the tests. The first complete or "A" test is then to be made, to be followed by the minimum "A" test, and that followed by the maximum "A" test. In case all of these tests cannot be made in succession the rule as to operating the dynamo four hours at six-tenths load is to be followed previous to each test. The same preliminary run to be made also before commencing the "B" tests.

Details of Tests.—The "A" tests are substantially of two hours' duration. At the beginning and end of each "A" test all conditions are to be maintained as nearly as possible, including the steam pressure, but to insure that all water in the boiler has become heated and swelled to correspond with the temperature the water level is to be allowed to rise a little higher in the gauge glass at the beginning and time called, and the test actually started as the water reaches a definite mark. The same course to be pursued at the close of the test, and the calculations based upon the actual difference of time. During each "A" test all the water pumped into the boiler is to be measured in suitable tanks. The load is to be maintained constant and indicator diagrams taken from the engine cylinders every ten minutes, and the time carefully marked on the same. All the current generated to be measured by a single ammeter, in addition to which an ammeter is to be placed in the shunt field circuit, and another, or equivalent, in the shunt of the series field, if one is provided. A standard voltmeter to be connected with the main armature terminals. For the alternating current dynamos a standard wattmeter to be used in connection with the ammeter and voltmeter. Velocimeter and engine counter to be connected with the main shaft. The ammeters and voltmeter to be read every minute and an average of such readings and the reading of the engine counter recorded in the log every ten minutes.

Determinations of the quality of steam will be made throughout the tests. The exhibitors complain that the steam is very wet, and that a lower economy will be obtained in consequence.

"C" Tests.—At the conclusion of a run during which the engine has been operating smoothly, the current is to be cut off of the main and field circuits, the field magnets made neutral by passing an alternating current through the coils if necessary, all stuffing boxes about engine containing flexible packing slackened,* and friction diagrams taken for about 15 minutes with engine running at normal speed and steam throttled so that it will be automatically cut off near the middle of the stroke and prevent the formation of looped diagrams. The field is then to be excited and indicator diagrams taken to compare with those of the previous runs so that from the difference in area there may be deduced the losses due to hysteresis, to Foucault or eddy currents, as well as the mechanical resistance due to eccentricity, etc. During these experiments records of the voltage to be taken for a time at the main terminals and again for a time, for armatures provided with multiple double parallel circuits, the leads connecting brushes of like sign to be observed and recorded for the purpose of ascertaining the influence of joints, blowholes and variations in the permeability, etc., of the pole pieces or yokes, or of other conditions affecting the symmetry of different parts of the field.**

The resistance of the armature and series field circuits to be determined with engine at rest and considerable current flowing by observing the drop of potential with a sensitive voltmeter due to a given current. Resistance of the brushes when running to be approximated by connecting a millivoltmeter between the brush terminal and an extra hand brush on the edge of the commutator opposite the brush tested.

Heating.—The "C" tests, with field excited, to be continued until the armature core attains a normal temperature, which is to be noted together with such observations as are found possible as to the rate of the rise of temperature compared with that of the air. The temperature of the armature to be also observed at the beginning and end of the several "A" and "B" experiments.

Determinations of the resistance with the temperature will also be made.

Organization for Conducting the Tests.—The tests in each case to be in general charge of a particular judge designated for the purpose. A number of judges designated as expert observers are to take such of the data as found practicable and certify the same. Expert assistants, preferably from the technical schools, to be engaged to take the remaining data. If practicable, the force organized by the judges of the Department of Machinery to take indicator diagrams may be employed for the same purpose in connection with these tests.

Publicity of Tests.—The instruments used to be of large size so that they may be read at a distance, and so far as practicable the companies represented may each have an expert observer to take each class of data in connection with the judge, or observer, detailed for the same. In case a mistake is detected, or if from any cause the apparatus in any detail is not operated properly or as prearranged, the attention of the judge in charge is to be immediately called to the same so that the mistake may be corrected or the experiment repeated at once. Protests as to facts made at a later period cannot be considered.

Standardization of Instruments.—In case the judges or the Department of Machinery arrange to take indicator diagrams and standardize the indicators the judges of this department are to co-operate with them in securing proper standardization, otherwise efforts to be made to have the same standardized by the Bureau of Steam Engineering of the Navy Department with the apparatus they provide for the purpose, or the work will be done under the direction of the judges with such apparatus as can be borrowed from instrument manufacturers and the technical schools. The electrical instruments to be standardized by judges of the group who are to report on this class of instruments and the results to be certified by the same.

Reporting the Results.—The exhibitors are to furnish the judges with small drawings of the apparatus tested, sufficiently in detail to convey to those familiar with the subject an accurate idea of the type and general dimensions of the apparatus. Conferences are to be had with exhibitors to see if they are willing to furnish particular information as to the quality of materials used, area of the different portions of the magnetic circuit, exact size of the conductors, the method of winding, the number of turns, methods and extent of insulation, etc., and if so this information to be embodied in the report. The reports are to at least show in condensed form the general results obtained in each class of test—all reduced to the same standard as to time and units. Conferences to be had with exhibitors to ascertain whether or not it is desirable to embody in the report the actual percentages of efficiency obtained under different conditions, or simply to state the results from which those familiar with the subject can calculate such percentages.

XI.—Polyphase Machinery.

The two-phase dynamos and motors of the Westinghouse and the Stanley companies have been examined by the committee and reported upon. They will not be tested, and awards will be given solely upon the design and construction of the apparatus, together with the practical results attained by these machines.

The three-phase motors and rotary transformers of the General Electric Company of New York and the Allgemeine Electricitats Gesellshaft, of Berlin, will, in addition to an examination, be subjected to several tests. The German concern is not in for an award because its director is a member of the committee of judges, but the company is willing to have the judges test its machinery in order to incorporate the results in the general report on the exhibition. The exact nature and extent of the tests have not been definitely decided upon owing to the uncertainty of some facilities, but all

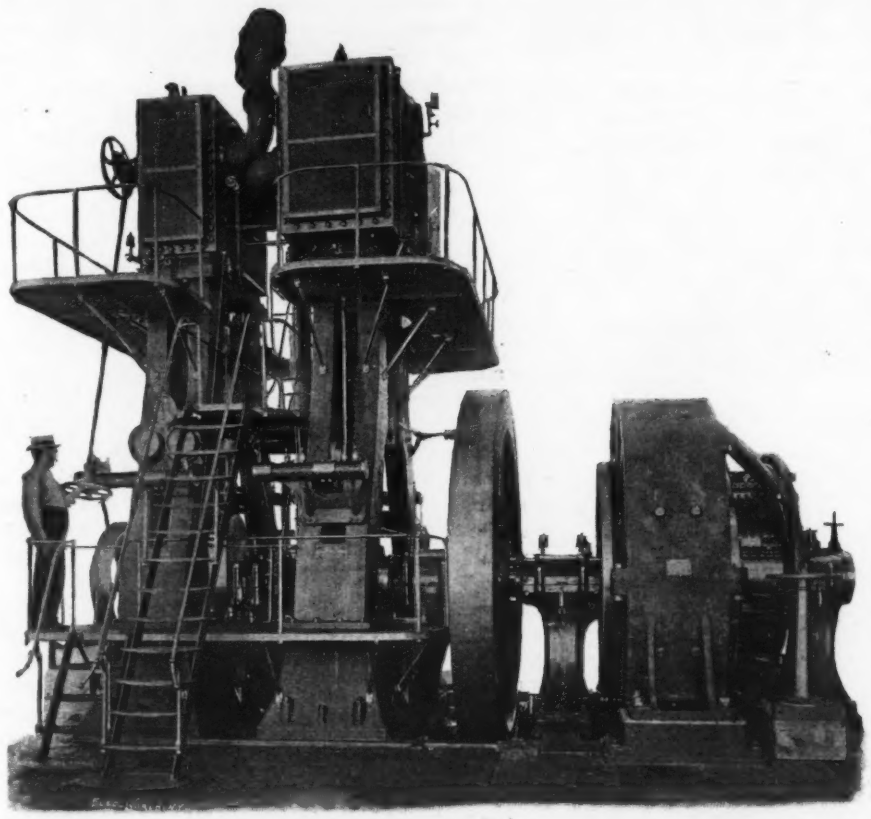

FIG. 1.—DIRECT CONNECTED ENGINE AND GENERATOR IN INTRAMURAL POWER STATION.

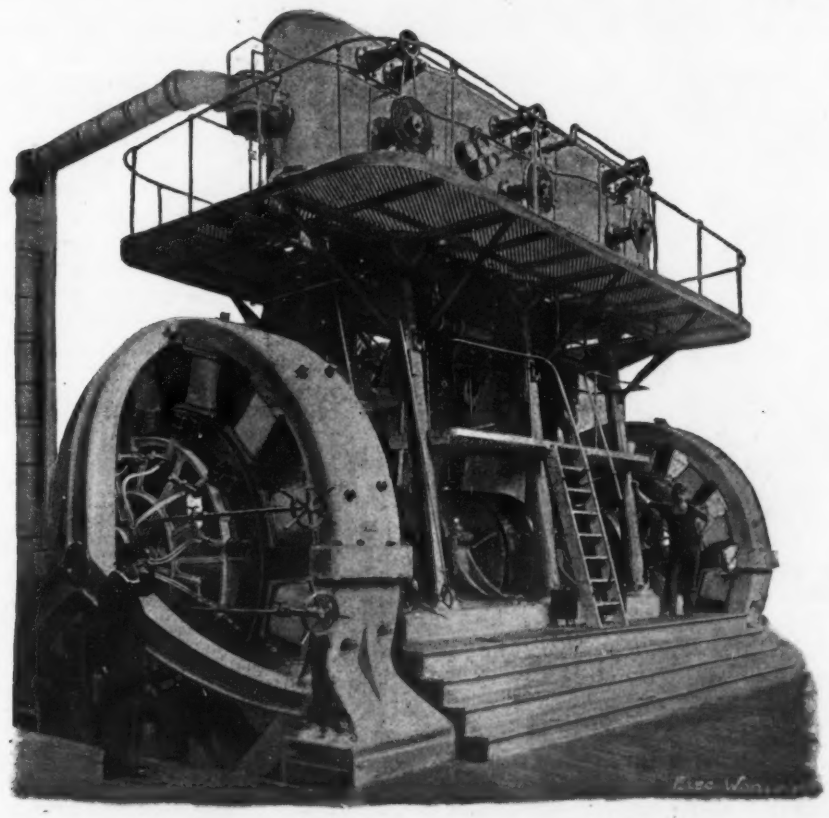

FIG. 2.—DIRECT CONNECTED ENGINE AND GENERATOR IN MACHINERY HALL.

*There was some objection made to slackening the stuffing boxes, and so they will probably not be altered.

**This was also objected to, but will doubtless be carried out.

the tests will be made that circumstances permit. The generators will simply be examined and not tested, owing to lack of time and facilities. The principal tests of the motors will be the starting torque, the current at no load, and input and output at various loads, from which the efficiency will be determined, and curves drawn of the variation of efficiency with load.

The input of the motors will be measured by determining the power factor by means of two non-inductive resistances placed in each circuit, and the individual and combined potential differences measured by low reading voltmeters. Weston instruments will probably be used. The motors will be loaded by being belted to a dynamo, thus avoiding the use of brakes. The output of the motor will be measured by the output of the dynamo, whose efficiency at various loads has been previously determined.

The starting torque will be measured by holding the wheel fast with a leather strap wound around and pulled tight, and the effective pull measured by two spring balances. The motors tested will be of about 10-kw. capacity.

The rotary transformers will be tested for efficiency by measuring the input in the same way as with the motors, and the output by means of a direct current ammeter and voltmeter. These will also be run at various loads and the speeds noted.

All the tests will be made at the exhibitor's space, as no laboratory facilities for testing electrical machinery have been provided.

Theory of the Transformer.—VI.*†

BY FREDERICK BEDELL AND ALBERT C. CREHORE.

In problems I. and II. of the preceding articles the effects of the variation of the secondary resistance upon the other quantities in a transformer were considered for the case in which the primary current was constant, and for the case in which the primary E. M. F. was constant. This was done, however, upon the supposition that there was no appreciable self-induction in the secondary circuit external to the transformer itself. It is our present object to investigate the modifications necessary when the effect of self-induction in the external secondary line is taken into consideration. The problem may be thus stated:

PROBLEM III.—The primary current is maintained constant in a transformer in which there is self-induction in the secondary circuit external to the transformer itself; it is required to find how the other quantities are affected when the secondary resistance alone is varied.

If we let L_t and L_ε represent the self-inductions of the secondary circuit of the transformer, meaning by L_t the self-induction within the transformer itself, and by L_ε that external to the transformer, we have the relation

$$L_2 = L_t \times L_\varepsilon,$$

where L_2 denotes the total self-induction of the secondary circuit. Instead of having the relation $L_1 L_2 = M^2$ as formerly, we now have

$$L_1 L_t = M^2.$$

By referring to the constant current diagram, Fig. 5 of Section IV. (May 27, 1893)in this series of articles, it will be found that, by introducing self-induction into the external secondary circuit, we do not change the primary current $\overline{OA}$, which is constant by supposition, and consequently do not change the impressed E. M. F. upon the secondary $\overline{OB}$, which is equal to $M\omega I$. The locus OCB for the effective secondary E. M. F. is therefore not changed. The diameter $\overline{OL}$ of the secondary current

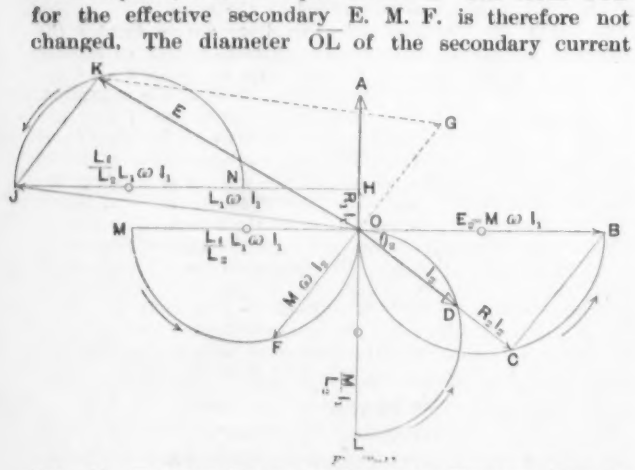

FIG. 19.—TYPICAL DIAGRAM SHOWING EFFECTS DUE TO VARIATION OF R_2 IN A TRANSFORMER WITH CONSTANT PRIMARY CURRENT AND EXTERNAL SECONDARY SELF-INDUCTION.

circle ODL, being equal to $\frac{M}{L} I_1$, in which L_2 has been increased by the addition of external self-induction, is diminished and the current is accordingly decreased by the external self-induction. This is to be expected when we consider that the effect of additional self-induction is always to choke or lessen the current, except in those cases where there is capacity present in circuit to neutralize the effects of self-induction.

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†For the previous section of this article, see THE ELECTRICAL WORLD, June 17, 1893, p. 447.

The secondary current being diminished gives a smaller back E. M. F. $\overline{OF}$ upon the primary than before. The diameter $\overline{OM}$ of the back E. M. F. circle that has been shown to be $\frac{M^2}{L_2}\omega I_1$, and in case of no external self-induction, this reduces to $L_1\omega I_1$, but now becomes $\frac{L_t}{L_2} L_1\omega I_1$, which is less than formerly, as the ratio $\frac{L_t}{L_2}$ is always less than unity. The diagram in Fig. 19 illustrates the changes which occur when there is external self induction. The primary E. M. F. triangle OHJ (for open circuit) is not changed. The back E. M. F. circle OFM, it is noticed, has a diameter $\overline{OM} = \frac{L_t}{L_2} L_1\omega I_1$ less than $\overline{HJ}$ which is equal to $L_1\omega I_1$. Since the primary impressed

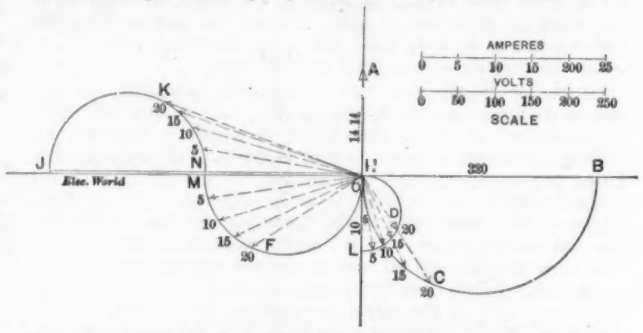


FIG. 20.—ACTUAL TRANSFORMER POLAR DIAGRAM, CONSTANT PRIMARY CURRENT. EXTERNAL SELF-INDUCTION, .016 HENRY. RESISTANCE VARIED. DATA: R_1 = .227 OHM; R_2 = .16 OHM; L_{t1} = .032 HENRY; L_2 = .016 HENRY; ω = 1,000. POINTS 5, 10, ETC., INDICATE POSITIONS FOR R_2 = 5, 10, ETC., OHMS.

E. M. F. has a locus JKN, symmetrical with OFM and determined by it, we see that the primary E. M. F. never can come into phase with the primary current as before, and a comparatively large angle must always exist between the impressed E. M. F. and primary current.

The more important features of this diagram, Fig. 19, which includes the effect of external self-induction in the secondary, will be readily seen by reference to the constant current diagram, Fig. 5, of Article IV. of the present series. Fig. 19 differs from Fig. 5 simply in the presence of the external secondary self-induction. The locus JKN of the primary impressed E. M. F. is shifted to the right by the secondary self-induction. In the constant current

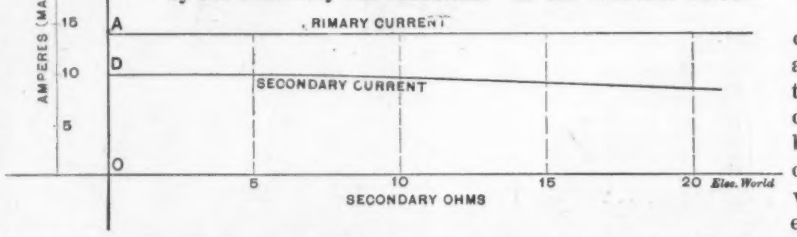


FIG. 21.—ACTUAL TRANSFORMER RECTANGULAR DIAGRAM CORRESPONDING TO POLAR DIAGRAM IN FIG. 20.

diagrams the loci of the variable quantities are in general semi-circles.

The typical diagrams do not indicate the extent of the modifications caused by the addition of self-induction to the secondary of a transformer, and it is well, therefore, to illustrate by the case of an actual transformer. In the constant current transformer, already considered in Article IV., above referred to, Fig. 9 represents the polar diagram and gives the data. Fig. 10 is the corresponding rectangular diagram showing the relations between the currents and potentials. Fig. 20 represents the change in Fig. 9 when self-induction is introduced into the external secondary circuit equal in amount to the secondary self-induction of the transformer itself; that is, the total self-induction of the secondary is doubled, and, where the old value of L_2 was .016 henry, now L_2 = .032 henry, L_t = .016 and L_ε = .016 henry. The external self-induction does not change the effective E. M. F. locus OCB, but it reduces the diameter OL of the secondary current semi-circle inversely as L_2 increases, so that the secondary current for no load becomes 10 amperes instead of 20, as before. At the same time the tangent of the secondary angle of lag θ_2, being equal to $\frac{L_2\omega}{R_2}$, is increased proportionately to L_2 for any given resistance. This fact allows a proportionately greater increase of the secondary resistance to reduce the secondary current to the same percentage as before. Fig. 21 is the rectangular diagram for the same transformer with secondary external self-induction and may be compared with Fig. 10. The secondary resistance may be increased to 20 ohms and cause the same percentage decrease in the current as was caused by an increase to 10 ohms when there was no external self-induction present.

It may be noted that by introducing external self-induction into the secondary of a constant current transformer, we may obtain a current constant throughout a greater range of ohmic resistance, although the magnitude of the current will be reduced.

A noticeable effect of the external self-induction is that it causes the secondary current $\overline{OD}$ to lag considerably more than 180 degrees behind the impressed E. M. F. $\overline{OK}$. According to all previous diagrams this has never been the case. The increased external self-induction makes $L_1 L_2 > M^2$. Similarly, if M alone should be diminished, L_1 and L_2 remaining the same (and this might be due to an increase of magnetic leakage in the transformer itself), we should have the same result that $L\ L_2 > M^2$, and it follows that magnetic leakage in the transformer causes the effect just described. The subject of leakage, however, will be deferred for the present.

Experimental curves have been obtained from actual transformers by Messrs. Berresford, Craft and Gherardi under the direction of one of us, and these closely correspond to those determined theoretically in this series of articles. These curves were obtained for constant current and for constant potential, and were recently presented before the Electrical Congress.*

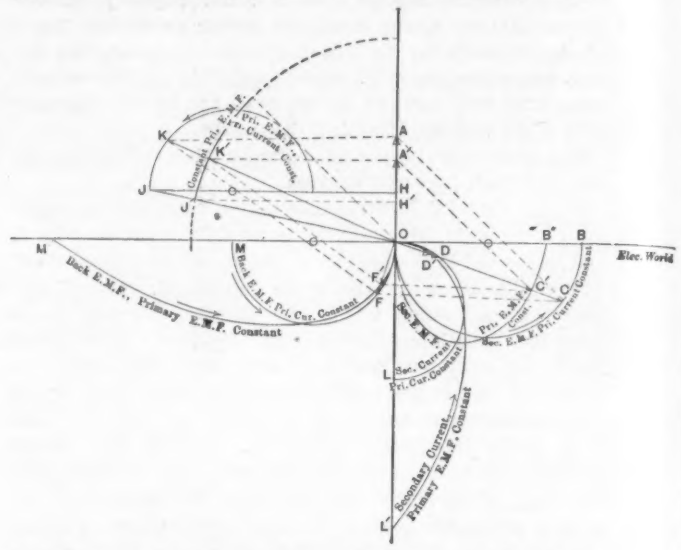


FIG. 22.—TYPICAL DIAGRAM SHOWING EFFECTS DUE TO A VARIATION OF R_2 IN A TRANSFORMER WITH CONSTANT PRIMARY POTENTIAL AND EXTERNAL SECONDARY SELF-INDUCTION.

The next problem to be considered is the investigation of the effect that the external self-induction produces when the primary E. M. F. is kept constant; the statement of the problem is as follows:

PROBLEM IV.—The primary E. M. F. is maintained constant in a transformer in which there is self-induction in the secondary external to the transformer; it is required to find how the various quantities are affected when the secondary resistance only is variable.

Fig. 22 is a typical diagram, illustrating this case. The constant current diagram similar to Fig. 19 is given here and transformed as before in the case of a constant potential transformer, by magnifying or diminishing the whole diagram for each point until the primary E. M. F. locus becomes a circle with O as a centre, so as to represent the constant potential case. For a comparison of this diagram with the constant potential diagram for the case where the external secondary self-induction is absent, see Fig. 11, Article V.

Perhaps the most noticeable effect of the external self-induction, aside from diminishing the current considerably, is the change in the effective E. M. F. locus OC'B''. This does not rise so abruptly from the origin and turn off toward B'' as suddenly as it did in Fig. 11, where there was no external self-induction, but it turns more gradually and does not keep constant throughout so great a range as formerly. These features are more easily seen by reference to the diagram Fig. 23, which represents an actual case where the transformer of Fig. 15 of the preceding article has self-induction equal to the secondary self-induction itself inserted in the external secondary circuit. Here the secondary current curve instead of extending

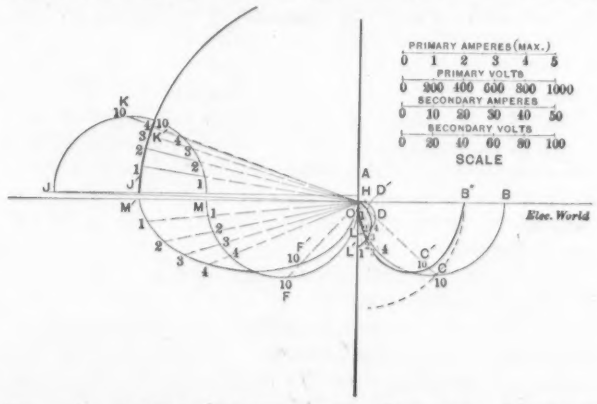


FIG. 23.—ACTUAL TRANSFORMER DIAGRAM, CONSTANT PRIMARY POTENTIAL. EXTERNAL SECONDARY SELF-INDUCTION = .0047 HENRY. RESISTANCE VARIED. DATA: R_1 = 50 OHMS; R_2 = .1 OHM; L_1 = 1.96 HENRYS; L_t = .0047 HENRY; ω = 1,000. POINTS 5, 10, ETC., INDICATE POSITIONS FOR R_2 = 5, 10, ETC., OHMS.

indefinitely downward stops abruptly at L'. The secondary current is never larger than $\overline{OL'}$ even on short circuit. When the resistance has only been decreased to 10 ohms it is seen that the effective E. M. F. has fallen away considerably. The change is so great and the regulation for constant secondary potential so affected that the transformer would be rendered useless for the purpose for which it was designed by the presence of so great a quantity of external self-induction.

*Bedell, "Transformer Diagrams Experimentally Determined." A paper presented before the World's Congress of Electricians Chicago, August, 1893.

The display of the Brush Electric Company, which is situated on the main floor, just west of the temple of the Bell Telephone Company, is one of the most prominent in Electricity Building, and merits the attention it attracts. While the Grecian pavilion and the tasteful arrangement of the various pieces of apparatus exhibited appeal to the artistic taste of the visitor, the careful selection of the exhibit also forms a history of arc lighting in this country, from its inception, and a practical illustration of its development and perfection at the present day. The interior of the pavilion, which is shown in one of the accompanying illustrations, is designed to illustrate a method for lighting theatres, churches and large rooms; light is thrown upward on the surface of the dome from incandescent lamps, entirely concealed from view by the frieze at its base, and from there distributed throughout the interior, giving an exceedingly even and soft light.

Among the features of the exhibit is the first practical arc lighting dynamo constructed in this country, by Mr. Charles F. Brush, and the largest arc light machine in the world, having a capacity of 125 2,000-c. p. arc lights; an alternating dynamo of 3,000 16-c. p. lamps' capacity, furnishing current to a circuit of 110-volt lamps, having the sectional bobbins connected in parallel. Brush machines of various capacities, including direct current compound-wound dynamos of 20, 30 and 50 and 100 kw. capacity, are shown; a 40-arc light machine, with 10 of the original lamps sold in 1881 and used until shipped to the Exposition; a 100-kw., 1,000-watt constant potential dynamo similar to the one used in the Calumet & Hecla mines; a crane motor; an ironclad mining motor and other interesting machines are also displayed.

In arc and alternating switchboards the company has some very beautiful designs, including special types of boards. These boards display very admirable workmanship, and contain all the improvements known at the present day. Perhaps the principal feature of the exhibit, however, may be considered the arc lamps, which are interesting not only from a practical standpoint, but from a historical view as well.

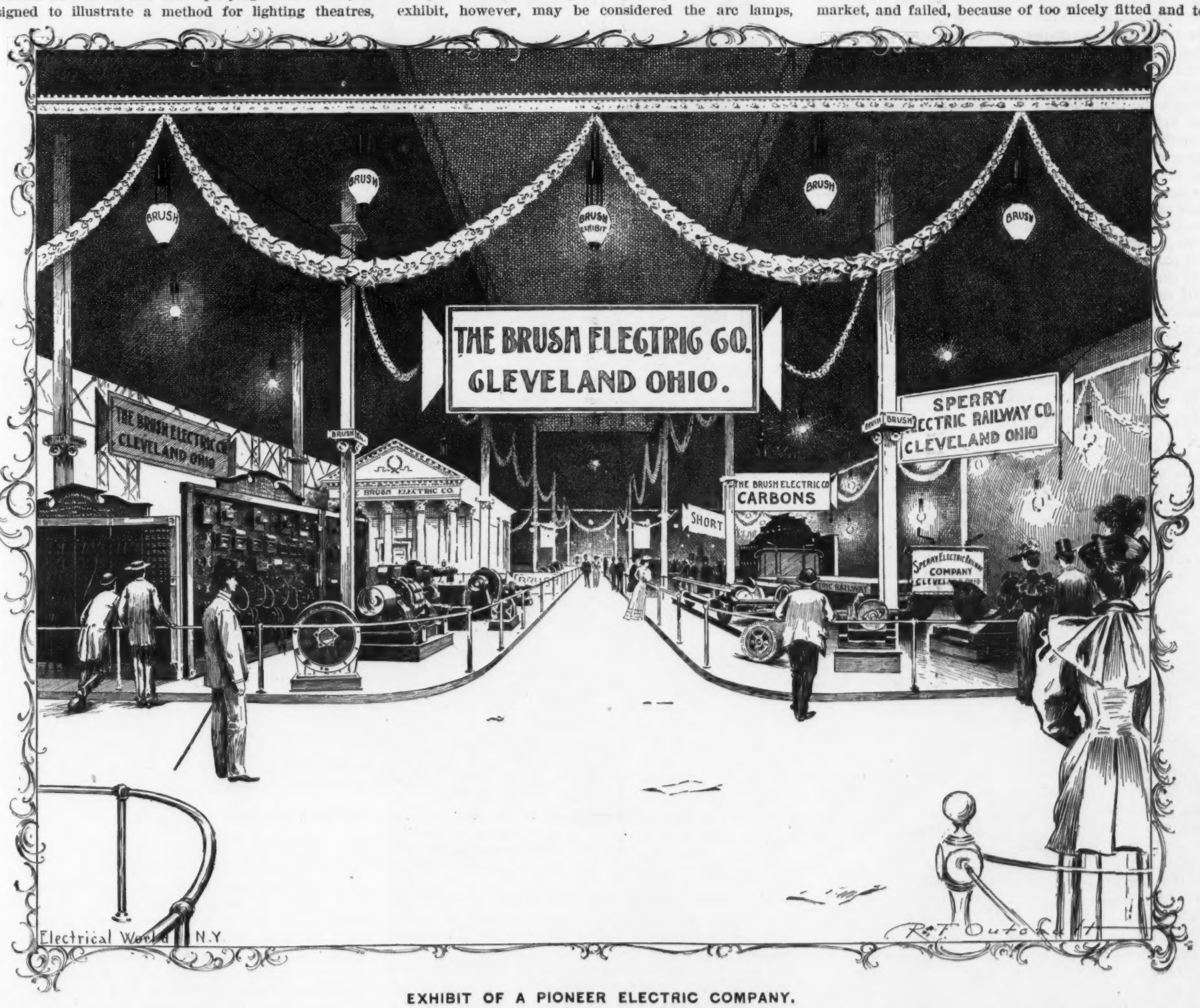


EXHIBIT OF A PIONEER ELECTRIC COMPANY.

THE BRUSH ARC LIGHTS AT THE WORLD'S FAIR.
BY T. E. ADAMS.

Here may be studied the history of series arc lighting, and with special interest do we look at lamps illustrating the progress made in applying this truly brilliant invention, for in series arc lighting the world is indebted to no one man so much as the man whose name is the designation of this company.

Remarkable, too, is the fact that the lamps here shown as the pioneers of their class embody all the essential devices now used by the most improved lamps of the present time. They are only lacking in the detail of construction such as experience has shown was advantageous in manufacture or a convenience to the user. Here may be seen long lamps and short lamps, single or double, focusing and non-focusing, but from first to last all of them are simple and strong. Much expense and bitter disappointment may be saved the ambitious designer of arc lamps, if he would stop and consider this feature of the lamps made by the Brush company. Dozens of more or less ingenious arc lamps, that would work well in the shop, and for a few months in actual service, have been launched on the market, and failed, because of too nicely fitted and too delicate parts. That the use of springs in an arc lamp is faulty is brought out in the Brush lamps as first made. Fifty thousand and more were made and sold, having a spring to adjust the length of the arc. That it would be desirable in an arc lamp to dispense with all springs that would have any effect on the arc was early seen, but it was only after much trial and test that the desired result was attained.

The "solenoid" form of main spools was replaced by "electromagnets" having a better magnetic circuit, and consequently greater strength. These spools being about one-third stronger than the first form, had several advantages; no spring was needed to assist them

in operating the mechanism of the lamp. Being stronger, the friction in the lamp remaining the same, the regularity of the lamp's action due to friction became a smaller item.

The form of the pole pieces of these electromagnets gives the armature the same range of movement that the armature of the solenoids had, with the additional advantage that they may be so shaped in relation to their armatures as to cause the arc on the second pair of carbons to burn either shorter or longer than the first, and to perform the two principal functions of an arc lamp, viz., "establishing and regulating" the arc, as the adjuster may desire.

The average condition of arc lamps that have been in actual service for some time is really what the maker should consider more than what ought to be their condition.

Experience shows the average lamp is not as clean and free from wear and abnormal friction as it ought to be. Probably it never will be. This being the case, the function known as "feeding the carbon" is the one most injuriously affected, and the light is poorest from lamps that feed by so-called "invisible degrees" though they may feed excellently when new and clean. This much-sought-after style of feeding may better be neglected and more attention given to the establishing of a full silent arc quickly, and maintaining the same practically constant, by the function known as "regulating the arc" until the clutch is again upon its "trip."

A good clutch should release the rod nearly as soon as it rests upon its trip, and grip it again with certainty as soon as the rod has moved downward. In such a lamp it is little matter if the rod dropped a little too far, for the time is so short from the feed till the arc is again at proper voltage as to be no practical disadvantage. In other words, if a lamp establishes and regulates perfectly with an easy releasing, sure gripping clutch, an excellent light can be maintained, though the lamp be in bad condition to feed well. In the new form of this company's lamp, this plan is thoroughly carried out, the clutch used being very durable and little affected by an imperfect or dirty rod. By filing the armature and pole pieces the lamp can be made to "establish" to an even higher voltage arc than existed when the act of feeding took place. When the armature and pole pieces of one of these lamps have been properly formed they will remain so permanently, and only the natural wear of the clutch and carbon rod will change its adjustment.

Of course, wear is inevitable, but trouble from it is made very remote, not only by largely increasing the usual wearing surfaces, but by placing the clutch trip as close to the carbon rod as possible, to prevent the multiplying effect of the wear. In this way an amount of wear that would send the old style lamp into the shop for repair has little effect on their new style lamp.

Not only has the cost of repair been lessened in this way, but provision has been made that the parts ever to be replaced shall be inexpensive and require but little skill to adjust them. Another improvement of the new lamp over the old is seen in the way in which the cut-out devices are designed and constructed. The burning out of cut-out spools that seemed a necessary evil in the old lamp has been entirely done away with in the new.

The regular cut-out is a mechanical one, being a brass bar to close circuit between two cut-out contact posts. As this bar is attached to the main lever loosely it will always make good contact, even if poorly fitted; being perpendicular, no dust can settle on the contact surfaces to make poor contact. The cut-out bar is so balanced that the lower edge will first make contact, and the tarnishing effect of the spark be confined to this spot. Untarnished surfaces will come in contact to carry the current, as the bar comes more fully on its seat.

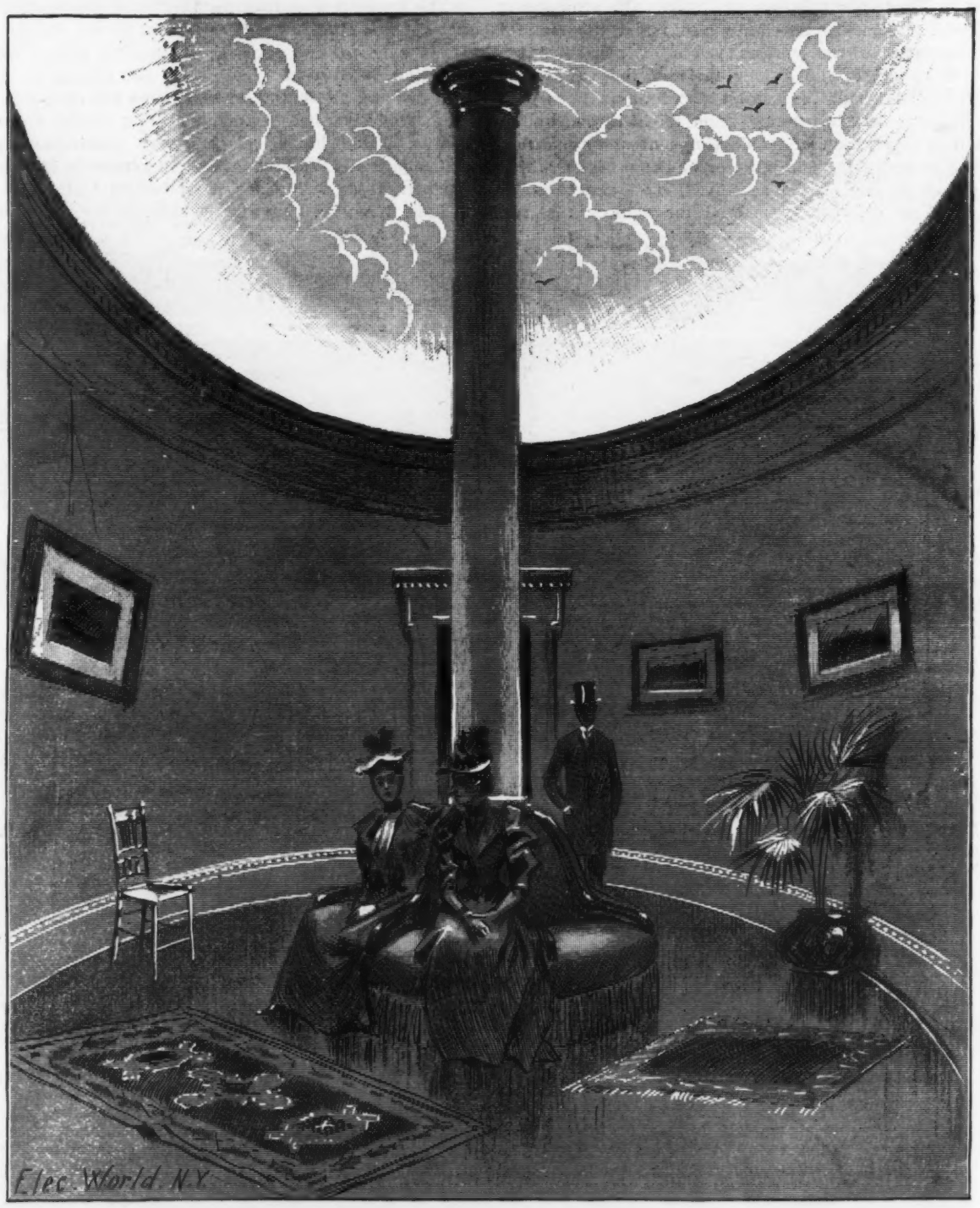
The weight of the moving parts of the lamp having the advantage of leverage holds the cut-out bar to its seat with considerable pressure. With this cut-out the main line is never open, should a trimmer forget to trim a lamp. The resistance coil is of such large wire and so perfectly ventilated that no risk of damage is run if lamps are left in circuit indefinitely after the carbons have been consumed.

The small spool in the lamp is an additional safety device, not at first sight understood. Its object is to prevent the burning out of the fine wire on the main spools, should the carbon be suddenly knocked out of the lamp.

If the main cut-out was wide open at the time this occurred, the current in the shunt would reverse the polarity of the main spools and prevent the main cut-out closing. If the lamp was burning on a machine of high E. M. F., a damaging current would be forced through the shunt of the lamp, as it is the only path remaining. The small spool being in this path will close a path around the main spools, and instantly the main cut-out would close, and, in turn, cut out the small spool. It is true this accident does not often occur, but the small spool costs little and may save a good deal.

The insulation is of the very best, no glycerine, oil, wax or mercury being used; no current is on any part of the frame. No solder is used in putting the new lamp together, a screw driver being the only tool necessary to take apart or reassemble the lamp. The carbon rod and clutches can be removed, while the lamp is hanging in position, without any tool at all, for the purpose of cleaning or inspection.

The carbon holders will hold 7-16-inch to ⅝-inch diameter carbons, and are easily adjustable to hold each size central, that were the upper carbon rotated it would not lap by the lower carbon. A recent improvement added to the new lamp is its form of globe holder. This globe holder is rigidly fastened to the frame by a thumb screw; it can either be lowered for trimming, or easily removed entirely. When a lamp is burning during zero weather, if snow blows in upon the heated parts (and in outdoor lamps this cannot be prevented), the water runs down and freezes before it has drained from the lamp. To prevent this from causing the trimmer any inconvenience, the guide rod of the double lamp globe holder is brought up between the carbon rods close to the arc, being heated by it, and transmitting this heat to the globe holder to an extent that will melt off any ice that may form there, either from melting snow or sleet. The ceiling or hanger boards for this new lamp are also an improvement over the old, in that there are no concealed wires or contacts; all parts and fastenings are in plain sight. The contacts are double and extra large; one circuit closed before the other is opened, and when a lamp is switched out it is out of all electrical contact with the circuit.



INTERIOR OF THE BRUSH PAVILION.

THE SPERRY ELECTRIC RAILWAY COMPANY.

This exhibit, which is in the southwest portion of the main floor, is especially interesting on account of the wide departure there shown from usual practice in electric railway construction. Instead of driving each axle of a truck by a separate motor, the Sperry Electric Railway Company drive both from a single motor, and have overcome the difficulties heretofore encountered where but a single motor is employed in a novel and interesting manner. Two trucks thus equipped are shown. In these the motor is flexibly suspended from the truck, and by means of a universal flexible coupling the rotation of the gear shafts running to either axle is maintained without difficulty, although the two shafts may be considerably out of alignment. This universal flexible coupling is a decided improvement upon previous attempts to provide for the same thing, and although exceedingly simple is difficult to describe. It should, therefore, be seen by all who are interested in new mechanical devices.

The motors employed are 40 h. p., ironclad, with hinged field of a type which has been called the "whaleback." It is exceedingly compact, and its construction is such as to protect it against water and dust, those two arch enemies of the street railway motor. At the same time, the hinged arrangement of the fields renders access to the working parts easy, and permits of the ready removal of the armature when it becomes necessary.

At the northeast and northwest corners of the space are shown the gear housing, with gear pinion and clutch, and between the two a 40-h. p. whaleback motor with hinged part thrown back and with armature running in before single field.

On the west side are shown the various parts of the universal flexible coupling where they may be handled and studied at leisure. In the southeast corner the operation of winding the Sperry armature with its ribbon conductors is shown. To add further interest to the display, one of the trucks is slightly raised from the tracks, so that when current is turned on the wheels are revolved and the action of the universal flexible coupling shown to better advantage.

THE SHORT ELECTRIC RAILWAY COMPANY.

Adjoining the Brush carbon exhibit, which lies directly to the south of the Sperry Electric Railway Company's space, is situated the exhibit of the Short Electric Railway Company, in which are shown trucks equipped with the gearless and single reduction motors.

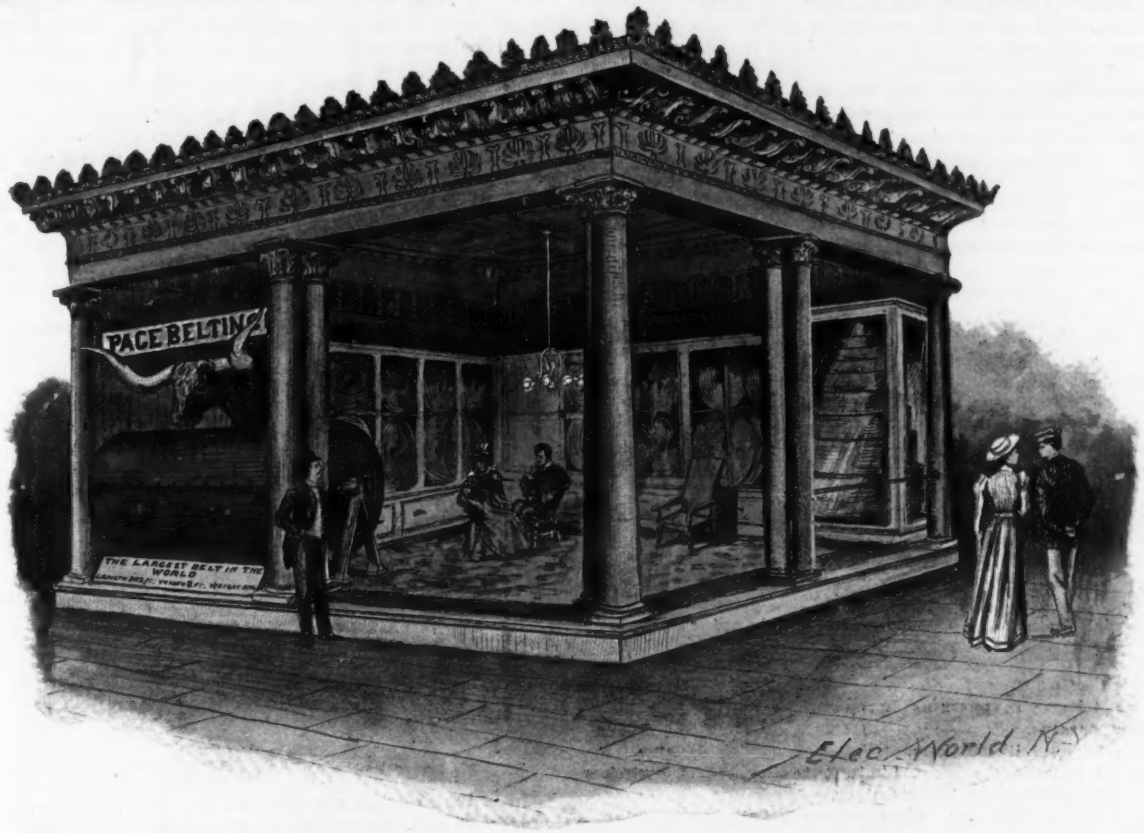
A six-pole gearless motor, adapted for use on 30-inch wheels, with motor suspensions so arranged that the motor rides upon its springs, forms one of the exhibits. The weight of this motor is 2,300 pounds. In this the driving device by which the motion is communicated from the 6-inch hollow armature shaft to the 4-inch solid wheel axle, is an adaptation of the Sperry universal flexible coupling referred to in the Sperry Electric Railway Company's exhibit. In this motor three of the field magnet cores are cast integral with the frame and three are consequent poles. The armature construction is a combination of ring and Tee tooth. The massive commutator is so cross-connected that half the bobbins are in series and the two halves in parallel, so that but two brushes are required. The regulation is claimed to be perfect, and rheostats are entirely done away with.

Diagrams of the starting curves of gearless, single and double reduction motors are tastefully framed, and are interesting in connection with the question of relative economy of the three methods of car equipment.

A sample of 20-h. p. gearless motor is also shown. The main piece of machinery in the exhibit is the large 425-h. p. street railway generator. This is multipolar (six poles), and constructed for slow speed. The armature, which is of the ring type, is 50-inch diameter; the length of shaft 13 feet, and the commutator of 300 bars is 30 inches in diameter, employing six sets of brushes, all of which are simultaneously set by a single hand wheel. The self-oiling bearings and armature shaft are so arranged that the armature can be centered between magnets while running. The speed is 150 revolutions, and the weight of the entire machine is 42,000 pounds.

A Short 30-h. p. single reduction motor built on the same lines as the 20-h. p. motor, with Gramme ring armature, is shown near by.

On a raised dais are placed large and small commutators and other parts of motors and generators, Ajax switches, ammeters, etc.; and a model electric railway switchboard in the southwest corner, with all the necessary apparatus, spools, wound and unwound, ball-bearing journals and photographs of apparatus, complete the display.



A LARGE BELTING EXHIBIT AT THE WORLD'S FAIR.

The Page Belting Display.

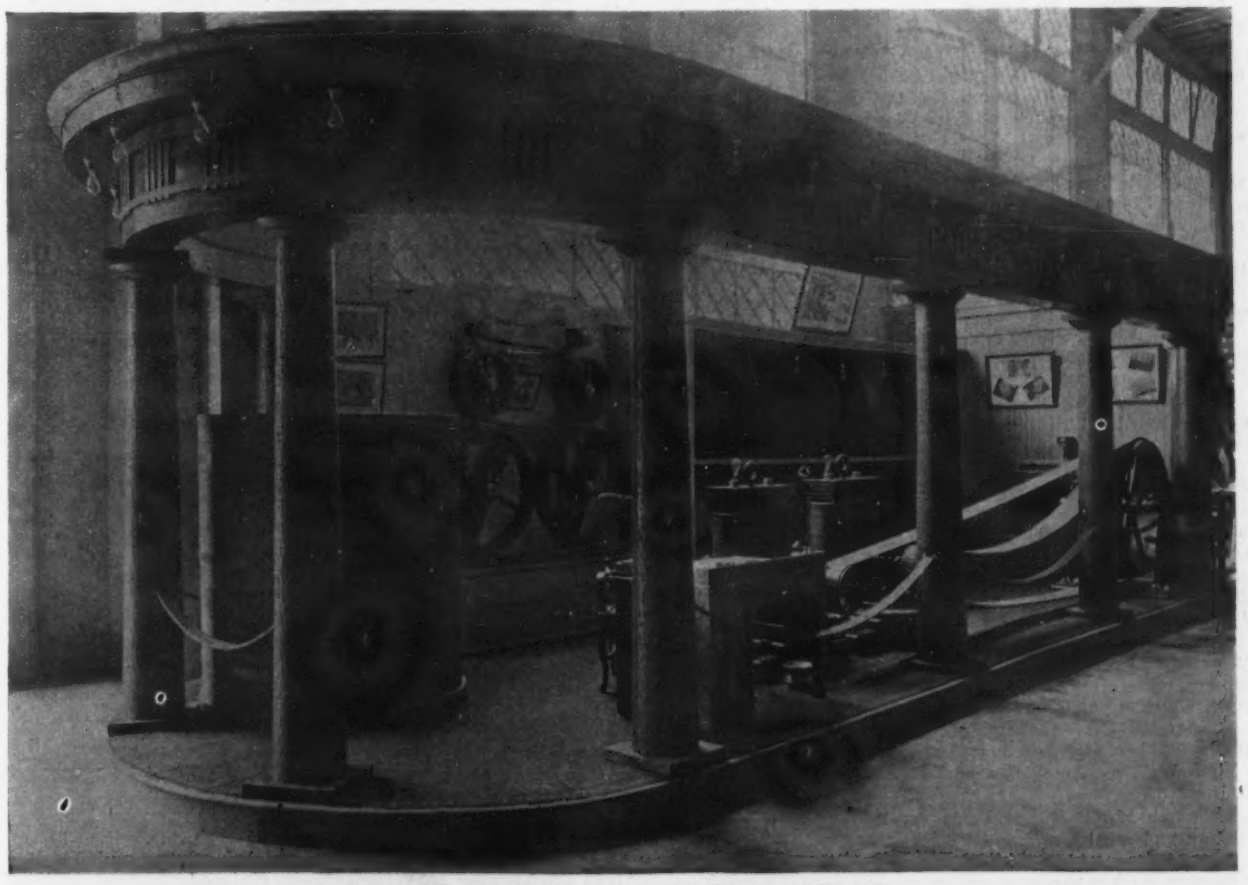
As already indicated in these columns the belting exhibits in Electricity Building are divided into two groups, one situated in the Northeast Bay and the other in the southeast corner of the space directly beneath the Northeast Gallery. The Page display belongs to this latter group and is located in D 5, directly adjoining the side entrance. In this space they have exhibited in a most attractive way the various styles of belts manufactured, both in the largest and smaller sizes, and here the visitor may examine them in detail and learn of the points of interest in their manufacture. But creditable as is this display, still more so is that other one they make in Machinery Hall, of their belts in actual operation doing work.

Of all the exhibits in Machinery Hall, that which is the most prominent and important is located upon the grand power stand directly opposite the main entrance from the Administration Building. This exhibit consists of the large Allis engine with its 30-foot fly-wheel. two enormous Westinghouse generators connected with the engine and driven by it through the medium of two enormous belts running tandem. At first it was proposed to construct the engine fly-wheel with a width of pulley sufficient to allow the belts to run side by side, but later it was determined that the pulley should be built in width 76 inches, and that the two belts should run one above the other, the two generators being set tandem. While the construction of a 2,000-h. p. engine may justly be regarded as an achievement in land engineering in America, and forms a fine advertisement for the manufacturers, E. P. Allis & Co., of Milwaukee, it is not an experiment in any sense, nor are the two generators driven by this engine experiments, as similar construction has prevailed with the Westinghouse people in the past. The experimental part of this exhibit consists in the running of the two leviathan belts, one over the other, or, as is ordinarily termed, tandem. One belt is 72 inches wide, 148 feet long, and drives the nearer generator. It is three-ply in thickness, and outside of this and running upon it is a three-ply belt 71 inches wide, 185 feet long, driving the farther generator. These belts are running at a speed of 5,600 feet per minute, and have at times been worked up to a load of 1,200 h. p. each. It required courage to furnish belts for this installation, but the Page Belting Company did not hesitate. Recently they have completed new works containing heavy machinery of the most approved pattern, including the largest hydraulic belt press ever made. This press produces the enormous pressure of 660,000 pounds. It was by means of this press that the belts were made, after which they were given a thorough running test on a special machine made for the purpose, employed by the Page Belting Company in the manufacture of all of their large belts. It is undoubtedly due to the fact of excellent facilities in the construction of the belts, and this thorough test that they were given before being sent from the factory, and the even character of the belts throughout, that they are able to transmit the large amount of power above mentioned, producing more than 20,000 incandescent lights, and to do it all with an ease and perfectness which is the admiration of every engineer and machinist who sees the belts in operation, for they run without perceptible wabble, vibration or flap, and as true as a die. These belts are waterproofed by a special method containing no oil or acid, which gives a surface that enables them to lie right upon the pulleys with most perfect contact, and thus they are able to transmit the large amount of power above mentioned while running slack. On the same platform is another belt 65 inches wide, three-ply, also furnished by the Page Belting Company, running at the same speed from the Fraser & Chalmers engine. This belt has been worked up at times to the transmission of 1,100 h. p. without difficulty. It possesses the same characteristics in every respect as its two larger neighbors. None of these belts have been touched since they were put on the pulleys, and there is every indication that they will go through the entire Exposition without being taken up or altered in any manner whatsoever.

All of the belts on the grand power stand are furnished by this company. The Page Belting Company has in operation at the World's Fair more than 300 belts, a large per cent. of which are employed in the transmission of power to electrical machines. The company also furnishes one belt in the Intramural station, a 48-inch double belt, which at times has been employed to transmit more than 800 h. p.

In addition to its exhibit in Electricity Building and the many belts it is running, it has also in Machinery Hall a large and varied exhibit of belting designed principally for transmission of power for general business. Here is exhibited the largest belt in the world, 203 feet long, 102 inches wide, 3-ply, weighing upward of 5,000 pounds. There were consumed in its manufacture 569 ox-hides.

There is also exhibited a pair of horns claimed to be the largest in the world.



A FEATURE OF THE PAGE BELTING EXHIBIT.

Awards at the World's Fair.

The juries appointed to pass upon the merits of the various electrical exhibits at the World's Fair have in part completed their duties, and the following general awards are announced:

UNITED STATES.

Albert & J. M. Anderson, Boston, Mass.—(1) Trolleys; (2) railway insulators.

Brush Electric Company, Cleveland, O.—(1) Direct current dynamos for series arc lighting; (2) direct current dynamos for series arc lighting coupled to engine, 125 2,000-c. p. lamps; (3) alternating current dynamos, constant potential, 36-150-kw.; (4) arc circuit switchboard; (5) direct current dynamos constant potential, 20-100 kw.; (6) arc lamps all types.

Bryant Electric Company, Bridgeport, Conn.—Snap switches.

W. R. Brixey, New York.—Underground, aerial and submarine telegraph and telephone cables.

J. H. Bunnell & Co., New York.—Standard dry batteries; (2) telegraphic apparatus.

C. & C. Electric Motor Company, 402 Greenwich street, New York.—(1) Direct current motors, constant potential, 3-50 h. p.; (2) electric motor, fan and blower combination motors.

Cutter Manufacturing Company, Philadelphia, Pa.—Brush switches for electric lights.

Commercial Cable Company, New York.—(1) Ocean telegraphic apparatus operating through Muirhead's artificial resistances; (2) Cuttriss improved cable telegraph apparatus.

Crane Electric Company, Chicago, Ill.—Electric passenger elevator complete.

Carpenter Enamel Rheostat Company, Bridgeport, Conn.—Rheostats.

Copenhagen Fire Alarm Company, Chicago.—Automatic fire alarm.

Geo. Cutter, Chicago, Ill.—Lamp supporting pulley.

Electrical Forging Company, Boston, Mass.—Electric heating and welding apparatus.

Electric Heat Alarm Company, Boston, Mass.—Thermostat for automatic fire, hot journal and hot grain alarms.

Electrical Conduit Company, New York.—Underground conduit for electrical wires.

Electric Launch and Navigation Company, New York.—Electric launches.

Eddy Electric Manufacturing Company, Windsor, Conn.—Direct current motors, constant potential.

Excelsior Electric Company, New York.—(1) Arc lamps series circuits; (2) direct current dynamos for series arc lighting.

Elektron Manufacturing Company, Springfield, Mass.—Direct current motors, constant potential, multipolar, slow speed; (2) automatic motor starter.

Electric Selector and Signal Company, New York.—Electrical system for locking and unlocking.

Edison Manufacturing Company, New York.—Edison, Lelande primary battery.

Eureka Tempered Copper Company, North East, Pa.—Tempered copper for use in electrical construction.

Fort Wayne Electric Company, Fort Wayne, Ind.—(1) Direct current "Wood" dynamo for series arc lighting; (2) alternating

current "Wood" dynamo constant potential compound wound 150 kw.; (3) arc lamps for constant current.

I. P. Fink, New York.—Screen reflectors for incandescent lamps.

General Electric Company, New York.—(1) Electric locomotives for factory and switches services; (2) electric elevated railway system; (3) long distance power transmission, plant in operation, triphase; (4) arc lamps for direct current series circuits; (5) search lights and focusing lamps; (6) transformers, 250-125,000 watts; (7) engine dynamos; (8) automatic overload switch; (9) electrically illuminated fountains; (10) Thomson eccentric coil ammeters and voltmeters for alternating currents; (11) pumping machinery driven by electric motor; (12) electrically driven rock-working machinery; (13) mine locomotive; (14) Haskins' Astatic ammeter; (15) arc lamps for constant potential circuits direct and alternating (Knowles); (16) jaw switches, fuses, sockets and branch blocks; (17) direct current dynamos for series arc lighting; (18) alternating current dynamos for series arc lighting; (18) alternating current dynamos, constant potential, 30-300 kw.; (19) system of street railway service; (20) direct current dynamos, constant potential (direct connected excepted), and direct current shunt wound motors, constant potential; (21) Edison feeder system for distribution of electricity; (22) slate switchboard for arc light circuits; (23) ventilating set, portable, government standard; (24) historical apparatus; (25) Edison three-wire system for distribution of electrical energy; (26) exhibit of incandescent lamps, all styles, ½-250 c. p.; (27) underground system complete in all details; (28) hoisting apparatus driven by electric motors; (29) integrating watt motor.

The E. S. Greeley & Co., New York.—(1) Testing instruments; (2) extra dry battery; (3) telegraph apparatus.

Gamewell Fire Alarm Telegraph Company, New York.—Automatic fire alarm telegraph system.

General Incandescent Arc Lamp Company, New York.—Arc lamps for constant potential circuits.

Hart & Hageman Manufacturing Company, Hartford, Conn.—Snap switches.

Helios Electric Company.—Arc lamp for alternating current.

The Hanson Battery Company, Washington, D. C.—Primary batteries.

Interior Conduit and Insulation Company, New York.—(1) System of interior insulating conduits; (2) snap switches.

Jenney Electric Motor Company, Indianapolis, Ind.—Direct current dynamos and motors, constant potential.

H. W. Johns Manufacturing Company, New York.—Vulcabeston and molded mica insulating material worked into all kinds of insulations.

Leclanche Battery Company, New York.—Leclanche batteries, especially the "Vole" and "Cylinder" cells.

Mather Electric Company, Manchester, Conn.—Direct current dynamo, constant potential, 500 volts.

McIntosh Battery and Optical Company, Chicago, Ill.—Electro medical, dental and surgical apparatus.

National Carbon Company, Cleveland, O.—Carbons for arc lamps.

Nutting Electric Manufacturing Company, Chicago, Ill.— Nutting arc lamp.

Otis Brothers, New York.—(1) Electric pump; (2) electric motor and controlling devices for elevator and hoisting service.

H. T. Paiste, Philadelphia, Pa.—Snap switches.

Police and Signal Company, Chicago, Ill.—System of police patrol telegraph.

Phoenix Glass Company, New York.—Electric and gas globes and shade cut, etched and colored.

Queen & Co., Philadelphia, Pa.—(1) Electrometer (Ryan); (2) galvanometer; (3) testing sets and resistances; (4) portable medical induction apparatus for physicians' use; (5) commercial ammeters and voltmeters.

J. A. Roebling's Sons Company, Trenton, N. J.—Bare copper and trolley wire.

F. A. Ringler & Co., New York.—Half-tone photo-electrotype steel faced.

Standard Electric Company, Chicago, Ill.—(1) Arc lamps for direct current series circuits; (2) direct current dynamos for series arc lighting.

Stevenson Hoggson Electric Company, St. Louis, Mo.—Automatic electric time stamp.

Sperry Electric Railway Company, Cleveland, O.—Electric railway system.

Short Electric Railway Company, Cleveland, O.—Short electric railway system.

Self-Winding Clock Company, New York.—Special application of an ironclad solenoid magnet.

Thomson Electric Welding Company, Boston, Mass.—Apparatus for electric welding and forging.

Union Electric Works, Chicago, Ill.—Primary battery.

J. C. Vetter & Co., New York.—(1) Incandescent current adapter; (2) dry Leclanche battery.

Western Electric Company, Chicago, Ill.—(1) Columbian street lamp post; (2) telegraph apparatus; (3) telephone cables, Paterson; (4) annunciators and signaling apparatus; (5) multiple switchboard for telephone service; (6) direct current dynamos for series arc lighting; (7) application of electric lights for the production of scenic effects in theatres and for the decorations of rooms, etc.; (8) arc lamps, various sizes, for series circuits; (9) arc lamps for constant potential circuits; (10) direct current dynamos and motors, constant potential.

Waite & Bartlett Manufacturing Company, New York.—(1) Holtz induction machines in airtight case with six 40-inch revolving plates; (2) special faradic apparatus for varying the tension and strength of current (Engleman's apparatus).

Washington Carbon Company, Pittsburgh, Pa.—Carbons for arc lamps, batteries and dynamos and motor brushes.

Wm. Wallace, Ansonia, Conn.—Historical electric light exhibit.

Walworth Manufacturing Company, Boston, Mass.—Poles for trolleys and arc lamps.

S. S. White Dental Manufacturing Company, Philadelphia, Pa.—Acid gravity batteries, "Partz."

Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa.—(1) Engine dynamos; (2) transformers, 250—12,500 kw.; (3) direct current dynamos and motors, constant potential bipolar and multipolar (except direct connected dynamos); (4) alternating current dynamos, constant potential 750 kw.; (5) electric street railway system; (6) alternating current dynamos for series arc lighting; (7) long distance power transmission, plant in operation; (8) two-phase alternating current motors (Tesla); (9) incandescent system of street lighting; (10) switches; (11) complete switchboard for controlling 17 dynamos and 40 currents; (12) lightning arresters.

Weston Electrical Instrument Company, Newark, N. J.—(1) Alternating current instrument, including wattmeters; (2) standard resistances and bridges; (3) electrical measuring instruments for physicians' use; (4) switchboard instruments; (5) direct current ammeters and voltmeters, standard and portable.

Western Union Telegraph Company, New York.—Instruments used in quadruplex telegraph, latest design.

Zucker & Levett Chemical Company, New York.

GERMAN.

Prof. Aron, Berlin.—Electric meters.

J. Berliner, Hanover.—Universal transmitter, long distance.

Geo. Carette & Company, Nuremburg.—Optical, physical and mechanical instruments and toys.

Dr. Edelmann, Munich.—Electro-medical apparatus.

Felton & Guilleaume, Muhlhausen on Rhine.—(1) Electric cables with special armor; (2) electric cables.

Gehmelzen, Nuremburg.—Carbons for arc lights.

Hartmann & Braun, Frankfort.—(1) Differential arc lamps; (2) galvanometers; (3) electrical measuring instruments, including instruments of precision; (4) photometer, large universal; (5) apparatus for testing iron and steel with respect to magnetic permeability; (6) reading telescopes, mirrors and scales; (7) portable measuring apparatus used in laying cables.

W. A. Hirshman, Berlin.—Electro-medical apparatus.

Imperial German Postal Telegraph Department, Berlin.—(1) Maps and drawings showing system of government telegraph lines using armored underground cables; (2) telegraphic apparatus of the German telegraph service; (3) historical telegraphic apparatus.

Korting & Matthiessen, Leipsic.—Arc lamps for constant potential circuits.

H. Schomburg & Sons, Berlin.—(1) Insulators and insulating material; (2) dry batteries.

Schuckert & Company, Nuremburg.—(1) Search lights with parabolic glass mirrors; (2) annunciators for vessels; (3) arc lamps for constant potential circuits.

Siemens & Halske, Berlin.—(1) Arc lamps for constant potential circuits; (2) direct current dynamos, constant potential 750 kw.; (3) historical apparatus.

Schmidt & Haench, Berlin.—Lummer-Brodhun photometer with accessories.

J. Zacharias, Berlin.—Dry batteries.

TURKEY.

Imperial Ottoman Government.—Telegraphic apparatus.

GREAT BRITAIN.

British Government Postal Telegraph Department.—(1) Modern telegraph apparatus in operation; (2) historical telegraph apparatus.

Corporation of Birmingham.—Original Woolwich dynamo.

General Electric Company, Limited, London.—H. I. switches and other incandescent house fittings.

James White, Glasgow.—Electromagnetic balances (Kelvin).

AUSTRIA.

F. Hardtmuth & Co., Vienna.—Carbon for arc lamps, etc.

RUSSIA.

Imperial Russian State Paper Manufactory, St. Petersburg.—Collection of electrotypes.

Imperial Artillery Arsenal, St. Petersburg.—Electrical registering attachment for testing machine (Prince Gagarian).

ITALY.

Prof. Galileo Ferraris, Turin.—Historical alternating current motors.

JAPAN.

Imperial University, Tokio.—(1) Seismographs and accessory apparatus; (2) model of an earthquake.

Department of Engineering, Imperial University, Tokio.—Automatic electric current recorder.

BRAZIL.

Directoria General dos Telegraphos, Rio Janiero.—Telegraphic apparatus.

An Improved Form of Instrument for the Measurement of Magnetic Reluctance.

BY A. E. KENNELLY.

A paper presented to the Electrical Congress.

Of the methods that have been adopted for the measurement of magnetic permeance or reluctance of iron, the Faraday ring test with ballistic galvanometer is generally admitted to be the most accurate and reliable. It is, however, essentially a laboratory measurement, requiring considerable time in preparation, execution and computation. For workshop measurements and comparisons, tractive and magnetometric methods have been employed with a convenience and facility usually obtained at some sacrifice in accuracy. Recently instruments have been used with success in which the reluctance of a sample bar of iron is compared with that of standard bars of soft Norway iron, notably the magnetic bridge of Mr. Thomas A. Edison exhibited at the Paris Exhibition of 1889, and the differential magnetometer of Mr. R. Eickemeyer. It is proposed to here describe a new instrument of this class, for which certain advantages may perhaps be claimed.

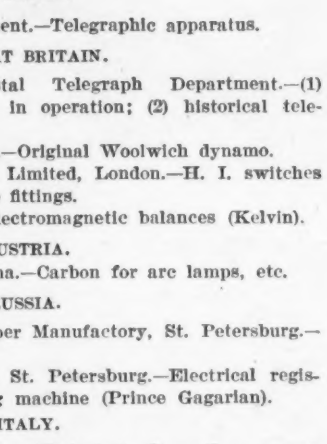


Fig. 1 represents the well known galvanic arrangement of circuits in which two resistances, R_1 R_2, can be compared by a null method. E_1 and E_2 are two equal and constant E. M. forces, inserted in the conducting paths A B and B C of equal resistance. The galvanometer G connecting the junction F of resistances with the junction B of electromotive forces will indicate no current when R_1 and R_2 are equal. The conductor F B corresponds to the neutral wire of a three-wire system of electrical distribution.

Fig. 2 represents the corresponding condition of magnetic circuits. A B C is a stout vertical frame of annealed Norway iron with two coils M_1 M_2 wound with the same number of turns of wire, connected in series so as to develop with regulated constant current strengths equal definite M. M. forces. The upright G corresponds to the galvanometer arm in Fig. 1, while the bars A F and F C are test pieces of iron having a cross-section considerably smaller than that in the remainder of the circuit. One, A F suppose, is a standard section made up of one or more bars of soft iron whose

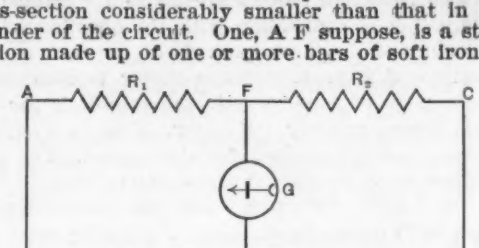


FIG. 1.

quality is known, while the other, F C, is the bar whose reluctance is required.

If the two reluctances R_1 R_2 are equal, the magnetic potentials at F and B will be equal, and the bar G will remain unmagnetized when the coils M_1 M_2 are excited. On the other hand, if R_1 and R_2 slightly differ, the potentials at F and B will not coincide, and magnetic flux will traverse the bar G. Since the magnetic circuits are all closed, the leakage through the surrounding air will be symmetrical and usually negligible, so that

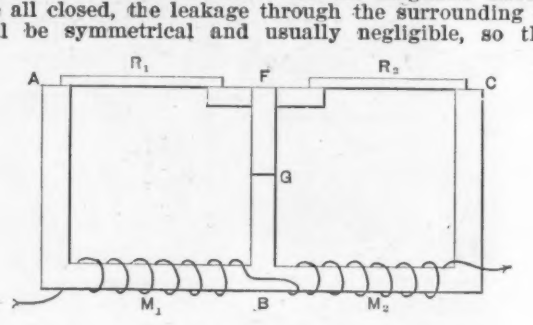


FIG. 2.

calling the flux through the main circuit Φ, and that through G, φ,

$$\varphi = \Phi \frac{R_1 - R_2}{R_1 + 2G}.$$

In order to ascertain whether flux did traverse the bar G, we might, according to established principles,* cut in imagination an indefinitely narrow gap or crevasse through G in a horizontal plane, and insert therein a magnet pole with apparatus to measure the tractive force to which it would be subjected. As the nearest practical approach to this plan we can cut a gap across G 1-16 inch (0.16 centimetre) wide, and swing in the crevice a flat disc armature, carrying a steady feeble current and with an attached pointer or index close to a fixed scale. We then obtain in all essential features the instrument here to be described.

Fig. 3 represents to scale in front elevation the actual instrument. D is the disc armature wound with 100 radial wires from centre to circumference. Half of this disc is always covered by the pole pieces above and below it. The unifilar suspension attached to the points P and Q supplies a current of about 10 milliamperes to this disc. A sensibly constant tension upon the suspension is obtained by means of a spiral spring within the lower slide tube, and it can be readily shown by experiment or computation that small variations in the tension of such suspensions have a very small influence upon the torsional moment.

The modus operandi is as follows: A sample strip or flat bar of the iron to be tested is laid across the gap F C. The breadth of the bar being conveniently one inch (2.45 cms.) and the height ½ inch (1.27 cms.),

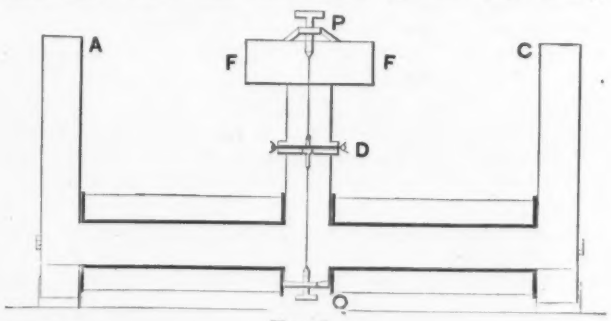


FIG. 3.

strips of soft iron to match this are laid across the gap A F in parallel, each being say 1 inch by ⅛ inch (2.54 x 0.318 cm.). If the disc circuit is then closed, and if there is no appreciable residual magnetism in the apparatus, the disc will remain uninfluenced and its index at zero. The field magnets are now excited in series with a suitable and measured current. The disc and pointer will now move to one side or the other about the axis of suspension according to the preponderance of reluctance between the two sides, and soft iron strips have to be added or removed across A F until balance is restored. Generally balance will be found between two adjustments of cross section at A F, and the proper amount can then be computed by proportional parts.

Steinmetz has shown† that from a series of such adjustments to equality between standard and sample bars at various excitations, the complete hysteresis curve of the sample can be deduced through the known valuations of the standard, but since a linear relation is found to exist between the reluctivity and magnetizing force in iron above the critical intensity, two such observations are theoretically sufficient to determine the reluctivity of the sample for supra-critical magnetizing forces.

The instrument can also be employed to readily indicate the retentiveness of sample bars of hard iron or steel. If after a balance has been obtained at a noted excitation, the excitation be withdrawn by interrupting the circuit of the coils M_1 M_2, and the standard bar is removed, the residual flux from the test piece will, dis-

* Clerk-Maxwell, "Electricity and Magnetism." Vol. II., par. 396.

† Transactions of the American Institute of Electrical Engineers, Vol. IX., p. 33. January, 1892.

regarding some slight loss by leakage, pass entirely through the air gap and disc at D. If the constant of the disc has been determined independently, the deflection of the pointer for the observed current through the disc will supply the amount of this flux.

If N denotes the number of turns in each spool,
I the current strength exciting the spools (amperes),
l the length of the test bar (cms.),
g the reluctance of the air gap at the disc (C. G. S. U.),
H_1 the magnetizing force in the bar during excitation,
H_2 the magnetizing force in the bar with excitation.

Then the M. M.F. of excitation is in each coil $\frac{4\pi}{10}$ N I; and since the intensity in the test bar is considerably greater than in the field frame, the magnetizing force brought to bear upon the test bar is nearly $\frac{4\pi}{10}\frac{N I}{l}$. After removing the excitation and standard bar, the observed residual flux encounters at the air gap a reluctance g, so that, neglecting the comparatively small hysteresis of the soft iron field frame, the counter M. M. F. at the gap is $-\Phi g$, representing an average demagnetizing force in the bar of $-H_2 = \Phi g/l$ nearly, so that the relative values of flux density are readily found with different sample bars for any selected value of H_1, or, more closely, for any consequent ranges of $H_1 - H_2$.

By mounting two opposed parallel plane iron plates between the uprights A and F, in such a manner that the length of air gap between them can be adjusted by a screw, it becomes possible to measure the reluctance of a bar placed between F and C by direct comparison with the reluctance of air. Trial has shown, however, that the additional contact surfaces involved, the dissymmetry introduced into the two sides of the circuit, and the uncertain leakage error with large air gaps, probably more than offset the advantage to be derived.

The errors attending the use of the instrument are: (1) The variability of reluctance in the field frame. (2) Errors in estimating the reluctance of the contact surfaces and the effective length of the test bar.

The first source of error depends upon the hysteresis in the iron of the field frame. It can be reduced to small limits by keeping the cross section of the test bar a sufficiently small fraction of the cross-section in the frame, thus bringing nearly all the reluctance of the circuit into the test bar. A correction can also be made for the outstanding frame reluctance.

The second source of error is common to all forms of permeameters in which straight test bars are employed in closed magnetic circuits. There will be a certain range of reluctance in the contact surfaces that can be kept in subjection by giving to those surfaces adequate area. There is also the more complex error due to misestimation of the effective bar length, for the reluctance of the bar will not only be encountered in the distance between the supports F and C, but also by some portion of the length resting on the supports. The virtual length of bar included in the circuit will thus be a function of the intensity within it and will not generally be the same for the test and standard bars.

The advantages of the instrument are: (1) Absence of hysteresis in the moving and indicating parts, which contain no iron. (2) Great sensitiveness and control. (3) Small reluctance in the narrow air gap or path of differential magnetization. (4) Convenience in comparing retentive powers in steel.

The writer desires to acknowledge his indebtedness to Mr. Thomas A. Edison, in whose laboratory this instrument was constructed.

The dimensions of a completed instrument are appended in detail.

Core diameters, 5.08 cms.
Core cross-section, 20.3 sq. cms.
Uprights, 5.08 x 5.08 cms.
Cross-section of uprights, 25.81 sq. cms.
Disc diameter, 7.6 cms. external.
Entrefer, 0.16 cm.
Approximate reluctance of entrefer, 0.00826 C. G. S. U.
Polar area above and below disc, approx. 20 sq. cms.
Mass of disc and pointer, 28 grammes.
Turns on each field spool, 3,213.
Diameter of suspension wire, 0.018 cm.
Deflection of pointer per ampere of current in disc, and per C. G. S. unit of flux through disc, 0.3 degree.
Thickness of aluminium disc, 0.035 cm.
Diameter of wire in disc radial winding, 0.035, silk covered to 0.042 cm.
Total thickness of disc, 0.077 cm.
Mean clearance of disc in air gap, 0.0415 cm.
Winding 100 radial wires carried round on rim and re-entering at common channel, never passing into air gap.
Available angular range of pointer, 140 degrees.

An Acknowledgment.

To the Editor of The Electrical World:

Our attention has been called to the fact that, in your admirable article describing our exhibit at the World's Fair, just published in your last issue, mention was not made of a motor regulating rheostat loaned to us by the Carpenter Enamel Rheostat Company, of Bridgeport, Conn., and used as a voltage regulator on the motor-generator loaned us by the Riker Electric Motor Company. The rheostat has been of great assistance to us and we desire to make due acknowledgment of the courtesy of the Carpenter company in making the loan.

Will you kindly publish this fact in your next issue?

THATCHER T. P. LUQUER,
Union Electric Company.

NEW YORK, Sept. 29, 1893

The Variation of Capacity of Insulated Wires with Temperature.

In the note on this subject by Mr. H. S. Hering, published in THE ELECTRICAL WORLD of Sept. 16, 1893, page 217, the following line was accidentally omitted from the copy: "or, if the specific inductive capacity of the vulcanized rubber changes very materially within these variations of temperature," which should be inserted between the words "outwardly" and "but" in the fifth line from the bottom.

DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE.

(Compiled from the principal foreign electrical journals.)

BY CARL HERING.

(NOTE.—Owing to a delay in the mails last week, the copy for this department was received three days after it was due—too late for insertion in that issue. The discontinuity caused thereby is to be regretted; nothing, however, will be omitted, and, although delayed, the Digest will continue to be a complete record.)

ELECTRO PHYSICS.

Plane of Polarization of Hertzian Oscillations.—"La Lum. Elec.," Sept. 2, contains an article by Mr. Righi on this subject, including, in the form of two parallel columns, analogies between the reflection of polarized light and the reflection of Hertzian oscillations, the latter including such phenomena as he has verified.

Rotary Magnetic Polarization.—In "La Lum. Elec.," Mr. Blondin discusses the recent researches in this field.

Interference of Electric Waves.—"La Lum. Elec.," Sept. 9, publishes the first part of a description of the researches of Messrs. Sarasin and de La Rive, from the "Arc. Sc. Phys. Nat.," 1890; one of the illustrations shows a view of the very large apparatus used.

Reflection of Electric Rays.—"La Lum. Elec.," Sept. 9, contains a description from an Italian journal of the researches of Mr. Garbasso on this subject.

Equi-potential Lines.—"La Lum. Elec.," Sept. 2, publishes an abstract of a paper by Mr. Lommel, read before the Bavarian Academy of Sciences.

Actino-Electric Phenomena.—"Electricite," July 6, contains an article on this subject by Mr. Blondin.

Perfect Sine Currents.—"La Lum. Elec.," June 17, contains an article by Mr. Hess on the elimination of the superior harmonics in periodic currents, and the production of perfect sine currents.

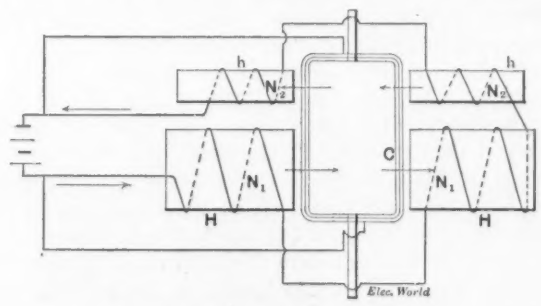
Electrometric Analysis.—The Lond. "Elec. Rev.," Sept. 8, contains a short note on this subject.

Electrical Transmission of Heat in Electrolytes.—"La Lum. Elec.," Aug. 26, contains a description taken from "Comptes Rendus" of the researches of Mr. Bagard on this subject.

Heat of Ionization.—The Lond. "Elec. Rev.," Sept. 8, gives a few constants taken from the paper of Mr. Ostwald.

MAGNETISM.

Compensator for Hysteresis.—In a recent issue of "La Lum. Elec.," Mr. Guilbert describes an ingenious arrangement of Mr. Abdank Abakanowicz in which the effect of hysteresis and remanent magnetism in certain apparatus may be entirely overcome; the device may be applied in measuring instruments containing iron, and in other apparatus in which it is desired that an attraction or a deflection is to be strictly proportional to the current. It consists essentially of a combination of several electromagnets acting in opposite directions in such a way that the resulting magnetic flux remains practically proportional to the exciting current. Its application to a wattmeter is shown in the adjoining



COMPENSATOR FOR HYSTERESIS.

cut; C is the revolving shunt coil; H H are the main magnets, and h h the compensating magnets; the former are made of soft iron having as little hysteresis as possible while the latter are made of cast iron or steel, having as much hysteresis as possible; they are connected in series, but their magnetisms oppose each other; by properly proportioning the cores, and the number of windings of each of the magnets, as also their air gaps, it is possible to make the resulting magnetism proportional to the current, that is, the difference between the ordinates of the magnetizing curves will be proportional to the current for ascending as well as for descending values; in this apparatus the torsion will, therefore, be proportional to the watts. To apply it to a core which is drawn into a solenoid he adds a second coil having a separate core connected with the main core, but moving out of its coil when the other moves into its coil.

Branching Magnetic Circuits.—Mr. Hanauer, in the "Elek. Zeit.," Sept. 8, describes a graphical method of solving the problem of branching magnetic circuits. He points out the analogy of Ohm's law with the corresponding law in magnetic circuits, and shows that Kirchhoff's two laws may be applied to magnetic circuits also; owing to the fact that the permeability of iron is not constant, purely algebraic calculations are not possible for branching circuits, but by using the Hopkinson curves he shows that graphical solutions are very simple; he gives illustrations of problems in magnetic circuits; in these the following law applies, in which the curves referred to are the Hopkinson curves: If the separate magnetic conductors are connected in series the corresponding curves must be added by adding their abscissae, and if in parallel their ordinates must be added; this method applies also for electrical circuits, including incandescent lamps, in which the resistance depends on the current; in a subsequent article he intends to show the application of his method.

Commercial Magnetism.—"Ind. and Iron," Sept. 8, in an editorial under this heading discusses the subject of units of magnetism, and shows how the quantity 4π enters into some of them; the surface of a sphere of unit radius is 4π; their mean, therefore, must be 4π lines of induction cutting the sphere and emanating from the unit pole at the centre.

Calculation of Coils with Reference to Their Heat Radiation.—Mr. Bachmann, in the "Elek. Anz.," Aug. 10, deduces a series of formulas for circular, rectangular and square cross-sectioned coils; they do not appear to be too cumbersome for practical use.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Measuring Self-Induction.—Mr. Boucherot, in "La Lum. Elec.," Sept. 9, gives a summary of all (?) the known methods of measuring self-induction. The descriptions are only quite general, and the discussions are of a theoretical nature; one of the principal points in the discussion is the effect of iron in the coils; in such cases it can be said that the coil has a certain coefficient of self-induction, but this coefficient is then variable, depending on the intensity of the current; the coefficient can then be defined as the quotient of the flux by the intensity of the current, but this is of little interest, as the coefficient never enters into a calculation alone, being always multiplied by the current. The paper scarcely admits of being abstracted. He divides the methods into non-integrating and integrating; among the first the only one which has been practically applied is that of Messrs. Arnoux and Cabanellas, which consists in measuring at every instant the difference of potential (E — CR) by means of a galvanometer or electrometer, giving rapid indications, the integration of which then gives LC, from which L is obtained by dividing by C; in the second method the same quantity is measured at a given instant by a process analogous to that of Mr. Mouton, by means of a revolving commutator; the third consists in employing an alternating electromotive force, and measuring this difference of potential and the current by the well known method of Joubert with revolving contacts; all these methods are of no interest when there is iron present, and they require an integration. Under integrating methods he mentions those of Edlung, Maxwell, Ledeboer, known as the extra current methods, in which the quantity of electricity is measured, which corresponds to the energy stored up by a constant electromotive force, or given out in the spark at rupture; in all these one must be very careful to avoid the presence of iron, if the formulas given by these authors are used; he discusses these at some length. Lastly, he describes and discusses the method of Joubert, in which the coil is placed in the circuit of an alternating current following the sine law; if the effective current is then measured by an electro-dynamometer and the effective difference of potential by an electrometer, the self-induction L can then be calculated from the formula

$$C = \frac{e}{\sqrt{R^2 + w^2 L^2}}.$$

The method is therefore quite simple, and according to that authority gives the best results, as the coils are measured under the conditions in which they are in practice; it is necessary, however, to use the same current strength in the measurement as that to which it is subjected in practice; the method gives a mean value; he investigates at some length the difference between this value and the real values of the coefficient of self-induction, and finds that the value of L is approximately 1.16 times the minimum value if the current is a sine function, and that it is equal to between 1 and 1.1 times the minimum value if the difference of potential is a sine function; a sine current is, therefore, the preferable one to use, as the result is then independent of hysteresis. In conclusion he says that it is possible to measure the self-induction exactly in applying these methods to circuits including iron.

"La Lum. Elec.," Aug. 26, contains an article by Mr. Blondel on the measurement of instantaneous and mean values of self-induction in circuits having a variable permeability. When the permeability is variable, he states that there is, strictly speaking, no coefficient of self-induction, as such a coefficient would be variable; the fundamental equation of induction ought, therefore, always be used in the form

$$e - Ri - \frac{d\Phi}{dt} = 0.$$

In certain cases it is preferable to replace the function Φ by one of the following:

$$L_1 = \frac{d\Phi}{di} \text{ or } L_2 = \frac{\Phi}{I}.$$

The latter is that which is usually called the coefficient of self-induction, and the former he proposes to call the true coefficient of reaction, as it is that which measures at every instant the effect of the reaction of the current on itself; he then shows that, contrary to a recently

made statement, L_1 can be determined experimentally exactly like L_2; he describes three methods for measuring it; the coefficient L_1 is the only one which one can determine directly in all practical cases; these methods give only instantaneous values, in practice mean values are usually used, which are determined by the well known Joubert method; regarding other methods, which have been given in books for determining the mean self-induction, he does not think that they can give good results in practice, for, in general, the coil is measured under conditions which are too different from those in which it is used in actual practice.

Measuring Induction Coefficients.—The "Elek. Zeit.," Sept. 8, reprints an abstract of a paper by Mr. Graetz, read before the Bavarian Academy, in which he describes a Wheatstone bridge combination, containing standard induction coils, in which the self and mutual inductions of coils of all sorts can easily be measured in centimetres or henrys.

Non-inductive Resistance.—Mr. Ducretet recently described before the French Society of Physics a non-inductive resistance made of a zigzag form of platinized glass; a piece of glass 3 by 4½ inches is sufficient for resistances varying from 25 to 100,000 ohms; the plate appears to be inclosed in a vessel filled with petroleum, thus preventing the injurious effects of moisture; by means of mercury it is stated that the resistance may be adjusted to any desired value.

Practical Measurements of Alternating Currents.—Prof. Fleming's fourth Cantor lecture is reprinted in the Lond. "Elec. Eng.," Sept. 8. For the first three lectures see the Digest, Sept. 16 and 23 (the complete lectures are published in the "Journal of the Society of Arts"). The subject is the measurement of alternating current energy, or, in other words, the discussion of meters; he first describes the so-called graphic meters, consisting simply of an ammeter or wattmeter, which move a pen point over a paper-covered drum revolving by clockwork; the advantage is that they record the current at every moment, but the disadvantage is that they are not self-integrating; he next describes the Shallenberger, the Wright-Ferranti, the Forbes, the Frager, and the Elihu Thomson meters, illustrating all but the last two, the last one being spoken of very highly. The above apply to the measurement of energy in non-inductive circuits; after discussing the requirements of a good commercial meter he discusses meters applied to inductive circuits—that is, central station meters for primary circuits; among such meters he recommends very highly the Elihu Thomson and the Mengarini when used in connection with a small transformer for reducing the voltage from 2,000 down to 100; experiments which he made with these two meters used with such transformers gave very satisfactory results; in the Thomson meter, for instance, the energy measured by other instruments in a four hours' run was 66.924, while that indicated by the meter was 66.946. These lectures are eminently practical, are entirely free from theories and mathematics, and although containing nothing new, are well worth reading by those interested in this subject; they constitute probably the best summary up to date; in conclusion he states that the measurement of alternating currents is now on an equally certain and satisfactory basis as that of continuous currents.

Prof. Fleming's third lecture, already abstracted in the Digest, is printed in abstract in the Lond. "Elec.," Sept. 8.

Measuring High Potentials.—The "Elek. Zeit.," Sept. 8, reprints an abstract of a paper by Messrs. Graetz and Fromm, read before the Bavarian Academy, in which they described an instrument for measuring potentials of electrical oscillations; a dielectric placed in a homogeneous electric field in a certain position will tend to rotate; the angle was made 45 degrees; the tendency is to place itself parallel to the lines of force; the deflection is proportional to the difference of potential between the condenser plates; the dielectric body was made of a circular disc of sulphur, 25 millimetres in diameter and 1.5 millimetres in thickness, and the condenser plates were 15 centimetres in diameter; for 1, 2, 3, 4, and 5 millimetre spark lengths he obtained the following differences of potential respectively, taking as a unit that for 1 millimetre: 1, 1.759, 2.257, 2.901, 3.353; with the same instrument the voltage of a 60-volt alternator could readily be measured.

Specific Resistance of Pure Copper.—"L'Elec.," Sept. 2, describes some recent tests, including the methods used, of Mr. Lagarde for making a redetermination of the specific resistance of pure copper. His conclusions are, that the resistance is 19.58 ohms (presumably legal ohms of 106) at 0° C. for a wire of pure copper 1,000 metres long and 1 millimetre in diameter. He also determined the temperature coefficient, and obtains as a mean 0.00445, which he says is fairly constant between zero and 40 degrees. It is also stated that this temperature coefficient is directly proportional to the conductivity of the copper, which law readily enables one to determine the coefficient for commercial copper of various conductivities.

DYNAMOS AND MOTORS.

Output as a Function of Size.—Mr. Schulz, in the "Elek. Zeit.," Sept. 8, determines, theoretically, the rate at which the output of a dynamo increases in relation to its dimensions; Deprez and Thompson state that the output increases as the fifth power of the linear dimensions; Froelich gives it as the fourth power; in the present article the author finds it to be the 2.5th power, provided the dimensions are all increased in the same proportion. In order to check this figure he calculates the output for four different machines of different sizes, and, by comparing the first with each of the others, he obtains the figures 2.6, 2.57, and 2.54. As dynamos of the same size can be built with widely different voltages, a figure applying to all cases cannot be given; to see how his figure applies to these, he calculates a number of machines of widely different voltages, and finds the number to be 2.21 and 2.93 for two different cases; but for dynamos, whose voltages do not differ too greatly from each other, a mean value of 2.6 will give good results in practice. In a subsequent article he proposes to discuss the subject of multipolar machines.

Continuous Current Machines Without a Commutator.—In "La Lum. Elec.," July 18, Mr. Boucherot discusses this subject and proves, mathematically, that, with the exception of so-called unipolar machines, a continuous current dynamo without a commutator is an impossibility, showing thereby that it is useless to waste any time trying to invent such a machine. (Judging from his writings, Mr. Boucherot is quite a reliable authority on such subjects.)

Sparking of Dynamos.—The article by Mr. Rechniewski, abstracted in the Digest last week, is concluded in "L'Elec.," Sept. 9; he discusses various methods, such as the Ryan, Sayer, Swinburne, etc., for diminishing sparking, all of which have already been described in the Digest, or are well known. A translation of this portion, including illustrations, is published in the Lond. "Elec. Eng.," Sept. 15.

Suppression of Sparking.—In "Electricite," Aug. 10, Mr. Guilbert describes various methods, all of which have already been described in the Digest.

Variable Speed Gearing.—"La Lum. Elec.," July 15, describes an apparatus of Mr. Giles, consisting of two identical electric motors driving a common pinion by means of beveled gears; when the speed of the two motors are equal there is no tendency for this pinion to move, but if they are unequal it will move around its axis at a speed equal to the difference between the two; the relative speeds of the two motors is regulated by the exciting currents. The apparatus is illustrated.

Marine Dynamos.—"La Lum. Elec.," July 15, describes two dynamos coupled directly with the engines, made by Mr. Fein.

TRANSFORMERS.

Transformer Litigation.—"La Lum. Elec.," Aug. 26, and "Electricite," Aug. 31, give a report of the suit recently decided, and already mentioned in these columns, in which the priority of invention of the use of transformers in parallel has been decided in favor of Messrs. Zipernowski and Deri, and that for transformers having closed iron circuits to those inventors together with Mr. Blathy; the litigation has reference to the French patents.

Transformer Design.—Mr. Weekes, in his serial in the Lond. "Elec. Eng.," Sept. 1, discusses the subject of efficiency with frequency, the quality of iron and transformers for different methods of supply.

ARC AND INCANDESCENT LIGHTS.

Multiple Filament Lamps.—The "Elek. Anz.," Aug. 24, describes and illustrates a lamp which has been used for some time in Rostock, Germany, which contains a number of filaments united in common at the upper part; each half can, therefore, be used with any of the others, thus enabling all but one-half of a filament to be used up or broken before the lamp must be renewed; the extra expense is much less than the equivalent in new lamps; furthermore, several filaments can be used at once, thus increasing the candle power (unless filaments be used which do not blacken the globe, there would probably be little economy, as the lamp bulb would become too black long before all the filaments are consumed).

Incandescent Lamps.—"La Lum. Elec.," Aug. 26, continues its series of profusely illustrated articles by Mr Richard on incandescent lamps, taken presumably from patent specifications.

Incandescent Lamp Manufacture.—In Mr. Ram's serial in the Lond. "Elec.," Sept. 8, he discusses the subject of glass blowing.

Lighthouse Lighting.—The paper by Mr. Blondel, mentioned in the Digest, Sept. 2 and 16, is reprinted in Lond. "Engineering," Aug. 4, and in "La Lum. Elec.," Aug. 26 and Sept. 2, in which the illustrations are given more fully than in the English electrical journals.

TRANSMISSION OF POWER.

Large Water Power Plant.—According to "La Lum. Elec.," Aug. 12, a syndicate has obtained a concession to utilize the water power of the Loire to generate light and power for the village of St. Etienne; there will be three dynamos of 300 h. p. each; three-phase dynamos are to be used.

Movable Electric Crane.—The "Elek. Zeit.," Sept. 8, describes and illustrates a new movable crane made by the Oerlikon company, mounted on a truck on rails, and taking its current from an overhead trolley wire.

Power Distribution.—Mr. Snell, in his serial in the Lond. "Elec., Sept. 8, discusses the various arrangements of leads for transmitting and distributing power, all of which are already well known.

ELECTRIC RAILWAYS.

Accumulator Traction.—"Lightning," Aug. 24, publishes an illustrated description (taken from the "Railway World," London) of the accumulator traction station at Birmingham; it is almost entirely descriptive, and gives only the following figures regarding receipts and expenses; two years ago there was a deficit of about $8,000, while last year the net loss was only $490; the engineer of the accumulator company, which has a contract for the maintenance of the cells, has found from a test that the cost of traction is 7.856 cts. per car mile; the total cost of the run (presumably of one whole trip), from the report by the company, was 33.1 cts., which was an increase of 2.23 cts. over that of the previous year (the length of one trip is not given); the accumulator company, it will be remembered, has contracted to maintain the cells and renew all wornout parts for any number of years at the rate of 3 cts. per car mile, an arrangement which is satisfactory to the traction company and quite remunerative to the accumulator company.

Blackpool Railway.—The Lond. "Elec. Eng.," Sept. 15, gives in detail the expense account of this road for slightly less than one year; the car miles run were 115,196, the total receipts about $35,000 and the expenditure, not including depreciation and sinking fund, about $20,000; a somewhat striking result is that the cost of the materials for the repairing of the motors (not including labor) is almost equal to the cost of the coal, while the cost of the material for the repairing of the channel, as also the wages for repairing the line, are each but slightly less than the cost of the coal. Mr. Hesketh, who makes the report, states that even with the greatest care and closest supervision the present channel system is not a success, that the present method of gearing is far from satisfactory and should not be continued in use, and that a single line cannot be worked without loss of time and great inefficiency; he recommends that new cars should have a single-reduction gearing with V spurs, or worm gearing, the former being the more efficient and the better system.

High Speed Railroading.—The Lond. "Elec. Eng.," Sept. 8, quotes briefly from a pamphlet by Mr. Behr regarding speeds of 120 to 150 miles per hour; he advocates electric traction, and confines his plans to the use of an elevated and built-up construction, the rolling stock being balanced on each side of the structure, and running upon a rail at the top, thus avoiding derailment at the high speeds named and bringing the centre of gravity below the point of support. Motors of 50 h. p. each are mounted on all of the car axles; the current wire is contained in a channel and is lifted up by the collector, making contact by its own weight.

"La Lum. Elec.," Sept. 9, contains a note in which attention is called to the fact that, owing to freight trains, for which such great speed is not necessary, lines would have to be constructed with four tracks; also, that, owing to the high speed, the curves, grades, switches, signals, etc., would have to be completely modified.

According to the Lond. "Elec. Eng.," Sept. 8, it is reported that Mr. Reynolds, at Wolverhampton, is designing and constructing a locomotive (presumably a steam locomotive) to run at a speed of 100 miles per hour.

Heilmann Locomotive.—The Lond. "Elec. Rev.," Sept. 8, quotes from a recent paper from Mr. Brown, in which he states that the large electric locomotive was started recently, that it runs remarkably smoothly, the faster it goes the smoother, the disturbing effects of the reciprocating masses being entirely eliminated; it is said to run more smoothly than a Pullman car.

Electric Locomotives.—According to the Lond. "Elec. Eng.," Sept. 8, four of the principal French companies are said to be making experiments with electric locomotives.

Series Traction.—In "L'Elec.," Sept. 2, Mr. Dieudonne describes briefly the method of regulating motors for series traction (that is, for constant current and variable voltage), consisting simply of shunting the field by variable resistance; it appears to contain nothing new.

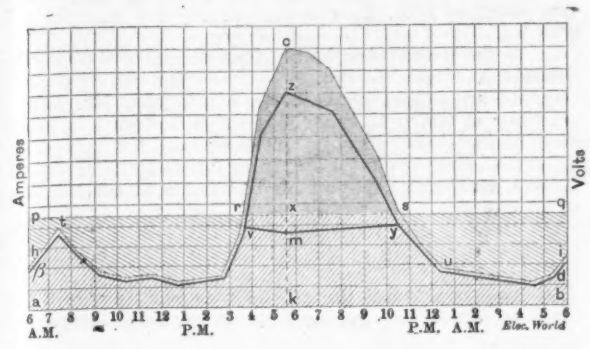
Salève Electric Railways.—The Lond. "Elec., Sept. 8, gives a short illustrated description of these mountain railways.

Muerren Railway.—"L'Elec.," Sept. 9, gives an illustrated description of this mountain road, mentioned in the Digest last week.

CENTRAL STATIONS, PLANTS, SYSTEMS AND APPLIANCES.

Gas Engine Accumulator Stations.—Several of the recent German papers publish an abstract from a pamphlet recently issued by a German accumulator company, pointing out the advantages of a central station run with gas engines fully loaded throughout the 24 hours, in conjunction with accumulators. The best abstract is that in the "Elek. Echo.," Aug. 5, which, at the same time, contains a number of cuts and diagrams of such a station, together with data from several of them in Germany. The load line in the accompanying diagram is a mean of the record of gas companies in

a number of cities in Germany, for the day of maximum consumption, which is usually the Saturday before Christmas; the line h r c s i represents the equivalent consumption of watts in the mains; the area below the line p q will then be the constant amount generated by the gas engines, which are run continually fully loaded, for, as is well known, their efficiency is then the best; the area r c s shows the amount given out by the accumulators, and, therefore, represents their capacity, the line c x being their maximum rate of dis-



LOAD LINE FOR DAY OF MAXIMUM GAS CONSUMPTION.

charge; the area a h t r s u i b represents the watt-hours sent directly to the mains by the gas engines, and the areas p r t h and s q i u, the energy stored in the accumulators, that is, their charge. By the use of accumulators, therefore, the capacity of the gas engine is reduced to about three-eighths of that required without the use of accumulators, which represents a saving of five-eighths in the capacity of the generating plant, besides the saving in economy due to running continually at full load. Several diagrams are given, showing the complete connections of a switchboard, including all the necessary devices.

Antwerp Electro-Hydraulic Distribution.—According to the Lond. "Elec.," Sept. 15, the scheme suggested by the late Van Rysselberghe is to be carried out. Water is to be distributed from steam pumping stations, at a pressure of 776 pounds per square inch; this is used to drive dynamos by means of turbines in small, local sub-stations, feeding into a low-pressure, two-wire, network; it is claimed that the cost of coal for one 16-c. p. lamp per hour will be only .025 cent, while gas at $1.25 will cost 1 cent for a 16-c. p. burner.

Christiania.—The "Elek. Zeit.," Sept. 8, contains a long, elaborately illustrated description of this station, the 23 cuts including plans, elevations, sections, switchboards, views, etc. One of the interesting features is that, although most of the current is supplied directly from the 250-volt dynamos to a three-wire circuit, in parallel with a battery of accumulators, there are, in addition, two double dynamos, in series with each other, whose junction is connected to the middle of the series of batteries which forms the neutral wire connection; with these dynamos the accumulators are charged; they serve, at the same time, to generate the increased potential for charging the accumulators; and to supply any difference in the consumption in the two parts of the three wire mains in case they are not balanced.

Central Stations.—Lond. "Electricity," Aug. 4, 11, 18 and 25, contains illustrated descriptions of the central stations at Feurstenfeld-Bruck, Leeds, Hull and Dundee respectively.

Train Lighting.—"La Lum. Elec.," Sept. 9, gives the first part of a description of train-lighting systems, among which is that of Dumont and Baigneres, in which accumulators are charged by dynamos driven from the car axle; there are two dynamos coupled on the same shaft; the large one, a shunt machine, containing some series coils, through which the current of the second machine is passed, the object of the combination being to obtain a constant E. M. F. with variable speeds; the arrangement is shown in a cut; it does not appear to provide, however, for maintaining the voltage at the lamps constant for both the charging and the discharging of the accumulators. The brush dynamo is shown which, by means of a centrifugal governor for moving the brushes, maintains the E. M. F. constant for all speeds between 1,420 and 620. A diagram of connections for car lighting is also given.

Portable Plant.—"Electricite," Aug. 3, gives a well illustrated description of the Fein portable installation for lighting, consisting of a complete steam generating plant and dynamo on wheels, and several cars containing a complete outfit for a temporary lighting installation.

Automatic Switch for Accumulators.—Mr. Leroy, in "L'Elec.," Sept. 2, describes and illustrates an apparatus for making or breaking the circuit of accumulators in order to protect them from injurious currents and reversals. It consists essentially of an apparatus resembling a dynamo with an H armature capable of making a revolution of about 90 degrees only; this operates a lever connected with a mercury-cup switch; the magnets and armature are wound with coarse and fine wire, one in series with and the other in shunt to the accumulators; it is specially adapted for strong currents, and is claimed to have advantages over other forms.

Accumulator Regulator.—Mr. Leroy, in "L'Elec.," Sept. 9, describes a regulator used in the Halles station in Paris.

Laval's Steam Turbine.—The Lond. "Elec. Rev.," Sept. 8, gives a brief description, accompanied by cuts, of this steam turbine, exhibited at the World's Fair; there are a number of points of interest regarding this turbine in which only one wheel is used, running at a very great velocity (20,000 revolutions); the economy is said to be very high; a 20-h. p. turbine has one wheel eight inches in diameter.

Power from Town Refuse.—Mr. Tomlinson's serial, mentioned in the Digest Sept. 16, is continued in the Lond. "Elec. Rev.," Sept. 8.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Ocean Telephony.—An anonymous communication to the Lond. "Elec.," Sept. 8, of a pessimistic nature, in referring to Prof. Thompson's paper on this subject, gives a number of supposed objections to trans-Atlantic telephony in general; among other things he calls attention to the fact that, owing to the difference in time, there are only three hours per day in common in the business hours of New York and London; to pay for itself the tariff would be absolutely prohibitive; another objection is that both persons communicating must be present; important transactions would not be carried on by telephone, as there is no record or evidence, and they may be overheard, coding being impossible; he believes that the advantages are altogether overestimated; for high-speed automatic telegraphy, at 400 words a minute, he thinks the cable would not be a success because at the present rate of 7,000 words a day the daily transmissions would occupy only 20 minutes, from which he concludes that there would not be sufficient traffic.

London-Paris Telephone Line.—450 words can be transmitted over this line for 10 francs ($2); with the telegraph only 48 can be sent for the same price.

Cipher Dispatches.—"La Lum. Elec.," July 8, describes a simple method of Mr. Hermann, for writing and deciphering cipher dispatches, consisting essentially of two concentric discs with letters around their peripheries.

Multiple Telephone Switches.—In "La Lum. Elec.," Aug. 26, Mr. Zetzsche describes the multiple switches of Mr. Jamolet.

Call for Telegraph and Telephones.—"La Lum. Elec.," Sept. 2, gives an illustrated description of the Breguet call.

Interlocking Railroad Signals.—The Lond. "Elec. Eng.," Sept. 8, in a note describes briefly the Ramsay-Weir system, in which electric motors are used. In "La Lum. Elec.," July 8, Mr. Zetzsche describes the Favarger system.

ELECTRO-CHEMISTRY.

Primary Battery for Lighting.—"La Lum. Elec.," Aug. 26, describes the Delaurier battery, the cost of maintenance of which is said to be relatively low. The zinc is not amalgamated, and is contained in a porous cup containing salt water; the positive pole is made of several sheets of carbon; the depolarizer is an almost dry paste made up of potassium alum (alum de potasse) 30 parts; sulphuric acid at 63 degrees, 5 parts; bichromate of potash or soda, 3 parts; this is placed in the bottom of the cup, the rest of which is filled with a 10 per cent. (by weight) solution of sulphuric acid; the advantages claimed are that it gives 2.3 volts, is remarkably constant during the whole discharge; that the zinc is not consumed on open circuit; that there are no creeping salts; that it may be left standing for three months without cleaning; that it requires little attention, and is cheap. With a battery of six cells of a capacity of about three-quarters of a litre (quart) each, and with positive electrodes each consisting of four plates, two small incandescent lamps can be run for 30 hours at 12 volts and 1 ampere; they will remain constant for 20 hours, and fall but slightly for the remaining 10; the quantity required for these cells will be 1 kilogram of the alum, 0.4 of the acid, 0.2 of the bichromate, 5 litres of acidulated water, and 3 litres of salt water; the total cost of one charge is given as 20 cents; the cost of the zinc consumed will be 10 cents, thus making the cost of a horse-power-hour 27.8 cents. It is claimed editorially that these figures should be modified, that the useful energy is only 600 instead of 828 watt-hours, from which, and other considerations, it is claimed that the price of a kilowatt-hour will be 50 cents; even this is very fair for primary batteries; for wholesale prices of the chemicals there will be a reduction of about 20 per cent.

Cells with Fused Electrolytes.—The Lond. "Elec. Eng.," Sept. 8, contains a note on this subject.

Pollak Accumulators.—The "Elek. Echo," Aug. 26, describes, with the aid of illustrations, the process of the manufacture of these accumulators; as will be remembered, the plates consist of sheets of lead, with numerous short spines over their surface, like coarse, short bristles of a brush; these are produced by rolling a plate between two rollers which raise the spines all over its surface; these rollers are made up of discs like an armature core, having notches cut in their outer edge; the plates are afterward formed by a rapid Plante process.

Electrolysis of Alkaline Salts.—"La Lum. Elec.," Sept. 2, gives an illustrated description of the Castner process, already mentioned in these columns, in which a diaphragm of mercury is used; as is well known, one of the greatest difficulties in such electrolysis lies in the diaphragm for preventing the solutions from mixing; in the Castner process there is a separate tank for each of the electrodes, the bottoms of which contain mercury, which extends beneath the partition separating the two tanks, thus connecting the two solutions electrically, preventing, absolutely, their mixture; it, therefore, acts as a perfect diaphragm, having a very low resistance; the mercury is kept in a continual state of agitation; two different forms of apparatus are shown.

Electrolysis of Chloride of Sodium.—"La Lum. Elec.," Aug. 26, describes the Craney apparatus.

Chlorate of Potash.—"La Lum. Elec.," July 15, states that an installation of 1,600 h. p., generated by water power, is being erected at Mansdo, Sweden, to be used in a large industry, in which chlorate of potash is produced electrically, for use in the manufacture of matches, according to a process invented by the director of that company.

Electrolysis at Definite Voltages.—Mr. Blount, in the Lond. "Elec.," Sept. 8, reviews an article by Mr. Freudenberg, from the "Zeit. f. Phy. Chem.," in which, after discussing the subject, he states that silver was separated from copper and bismuth in nitrate solutions at 1.3 volts; with 1.7 to 1.8 volts silver was separated from arsenic, and with 1.2 to 1.3 volts from antimony and 1.6 volts from cadmium; similar separations were obtained of other metals from one another.

Separation at the Boundary of Electrolytes.—The Lond. "Elec. Eng.," Sept. 8, mentions a paper by Mr. Jahn from the "An. Phys. Chem.," in which he shows that a current passing through two solutions of the same salt at different concentrations, from the greater to the less, causes a separation of the hydroxide of the metal at the boundary of the solutions; such a separation was noticed with the salts of a number of metals; where the hydroxides are soluble their presence can be shown by a reaction; the author is inclined to regard the above phenomena as evidence that water plays some part in the electrolysis of salt solutions.

Migration of Ions.—According to the Lond. "Elec. Rev.," Sept. 8, Mr. Nernst, in a recent paper, which is praised very highly, gives the following law: At a given temperature each sort of molecule has a constant ratio of distribution between solvent and vapor, or between two solvents, independent of the presence of other sorts of molecules, and whether reacting chemically with them or not.

Electrometallurgy of Gold.—"La Lum. Elec.," Sept. 9, mentions in a note that in the Molloy process gold and platinum may be extracted from their chloride or bromide solutions by an amalgam of an alkaline metal in contact with water, which develops hydrogen and reduces the metal; the amalgam is obtained by the electrolysis of an alkaline salt, in which mercury forms the cathode.

Aluminium.—"La Lum. Elec.," July 15, gives a number of receipts for aluminium solders, and describes the Willson process for the electro-thermic production of aluminium bronzes, with the aid of the arc, also another method, in which the heat is generated by passing the current through the crucible itself; both apparatus are illustrated.

Electric Disinfection of Sewage.—In "L'Elec.," Sept. 2, Mr. Montpelier gives a description of the Hermite and the Woolf processes (the latter is in use near New York), both of which are well known.

MISCELLANEOUS.

Electric Light and Vegetation.—The Lond. "Elec. Rev.," Sept. 8, calls attention to a paper of Mr. Chodat in the "Arc. Sci. Phys. et Nat.," No. 28, in which he demonstrates that electric illumination exercises a favorable influence on the germination of seeds; on herbaceous plants it promotes the lengthening of leaves and stems; under glass it greatly accelerates growth, the green color becoming more intense; prolonged exposure, however, acts deleteriously; the plants must not, therefore, be "drenched" with light, any more than they should be drenched with water.

Impregnating Wood.—"La Lum. Elec.," Sept. 9, illustrates and describes briefly the Oncken process, in which the logs are placed in a closed vessel containing hot solutions of the salt, through which a current is passed from one end to the other lengthwise in the direction of the logs; by the combined action of the current and the heat, the wood is impregnated in one hour, while without the electric current it requires from 10 to 40 hours.

Heating, Welding and Forging.—"La Lum. Elec.," Sept. 2, contains a very well illustrated article on various processes and machines, including those of the Electrical Forging Company of Boston (Angell & Burton); Coffin, Arnold, Hill, Howard, Procunier (for tempering); soldering irons of Meitzler, and several of Jenkins.

Earth Currents.—"La Lum. Elec.," Aug. 26, describes briefly some observations at St. Maur regarding recent abnormal earth currents.

Chronological History of Electricity.—The recent issues of "La Lum. Elec." contain a series of articles on this subject by Mr. Mottelay.

Mr. Martin's Lawsuit—Its Object Cash, Not Vindication—Fruitless Exertion—Why and How It Failed.—II.

At the time of the trial, of the four or five men who during the period of the trouble had been close to Mr. Johnston and cognizant of the facts, not one remained to afford any aid to The Electrical World in this contest.

On the contrary, these were all then friendly to Mr. Martin, and four of them were witnesses in his behalf.

With them it seemed a case of stand or fall together.

Knowing all this well, neither Mr. Johnston nor the company sought any compromise with Mr. Martin, nor did they strive to take advantage of technicalities which their counsel advised them might be made available to defeat his action. Their counsel even went so far, under their instructions, as to offer to allow Mr. Martin to change the basis of his lawsuit so as to place it entirely upon the question whether his discharge was rightful or otherwise.

It cannot, therefore, be said on behalf of Mr. Martin that he made a mistake merely in commencing his action—as he did—founded on this letter of June 7, and that having commenced it on that basis he could not retreat, and that he was beaten, as any man might be in a lawsuit, by the uncertainty of the law. This cannot be offered as an excuse for Mr. Martin's failure, or as a reason why he did not from the outset squarely and openly try with Mr. Johnston the question as to which of them was in the wrong.

As the case thus stood, there was no question of fact in dispute between them; there was nothing brought against Mr. Johnston except his own imprudent letter, and nothing remained except to have determined the question which arose on this letter. Of course, Mr. Johnston did not dispute that he wrote the letter, and, admitting that he wrote it, all that remained for the Court to decide was whether or not it gave to Mr. Martin the advantage he claimed it did.

This being the state of affairs a few days after Mr. Martin closed his case, defendants' counsel made a motion to have the complaint dismissed on the ground that as Mr. Martin's action did not proceed on the theory that he was wrongfully discharged, he was not entitled to succeed in getting specific performance of the contract—in other words, possession of the 20 shares of stock and the guaranteed dividend for the year 1890,—simply because Mr. Johnston wrote this letter of June 7.

The defendants contended that that letter could not be made to take the place of actual performance on Mr. Martin's part, as his counsel claimed, and that so long as he failed to show actual and full performance he was not entitled to come into court and demand that the defendants give him actual and full performance; that Mr. Johnston could not be made to pay for something which he never got, notwithstanding that he might have written some words in that letter of June 7, which by a certain amount of twisting could be made to imply an admission on his part that he did get it; and also that as the contract was now at an end, having been abandoned by Mr. Johnston, by his action in discharging Mr. Martin, Mr. Martin was, by the terms of the contract itself, no longer entitled to hold any stock whatever in the company.

In reply to this motion Mr. Martin's counsel made the argument which we have already quoted, and said much more to the same effect, his principal point being that because of the letter of June 7 the law "must deem Johnston to have waived any failure of performance." Not that Johnston did waive, but that the law must deem or consider in Martin's favor that he did.

Some days after this motion was made, and on July 9, 1891, the Referee gave what he called a provisional expression of his views on the motion. In doing so he took pains to state that he would not commit himself as to the correctness of what he said; and further that he merely gave expression to the impressions he had formed, from a rather hurried examination, of the questions involved in the motion; and that he did so because the counsel on both sides showed a desire to hear them.

It is not necessary to quote this opinion of the Referee at length. It will suffice to say that the substance of it was that as the case then stood, that is, on Colvin's evidence and the documents on which Mr. Martin relied, he saw one objection which was of itself sufficient to defeat the action, viz., that Mr. Martin was not entitled to that which he claimed—specific performance of the contract—*possession of the stock.*

That meant that the Court could not upon the evidence brought forward by Mr. Martin give him the physical possession of the 20 shares of the stock which he would have been entitled to for the year 1890, the Referee holding that he had a remedy at law in an action for damages; that is, damages such as were caused to him by being discharged, and by such discharge being prevented from acquiring the right to the 20 shares of stock at the end of the year 1890.

That, as the reader can at once understand, involved the opening up of that question which Mr. Martin apparently wanted above all others to avoid.

Thus arose the unforeseen circumstances we have before referred to, which induced Mr. Martin to become a witness in his own behalf.

Whatever may have been in his mind up to that point, one thing is certain—he was not over anxious to go upon the witness stand and tell it.

From the facts as disclosed up to that time, and from the facts as disclosed by all that followed, we should say that Mr. Martin was prudent to stay off the witness stand, and be content to keep himself all the secrets of which he appeared at this time to have been the sole possessor. His proxy witness, Mr. Colvin, did not disclose anything so marvelous or startling as to satisfy us that he had been the equal of what the plaintiff himself would have been in the same role. It was only the gentle persuasion brought about by the action of the defendants in moving to dismiss his complaint and the plain intimation conveyed by the opinion of the Referee which induced Mr. Martin to undertake the task of narrating under oath the "wrongs" which months before he had suffered.

When the Referee had expressed his views, he announced that he would hold the matter until the Saturday afternoon following, and give it more thought than he had been able to do up to the time at which he was speaking. Mr. Martin, however, was not seemingly desirous to have him spend any more time in considering his case as it then stood. Here, again, his foresight was sharp. He saw what was coming and at once concluded he would make one more effort to supply what the Referee plainly said was lacking—evidence to entitle him to judgment. Then this occurred:

Mr. Keigharn (to Mr. Masten): What will you do?

Mr. Masten: I shall offer further proof.

Mr. Keigharn: Will you accept the offer which I made you to change the cause of action?

Mr. Masten: I apprehend that this is a formal matter. I shall put in proof on the cause of action for breach of contract and claim damages on it.

It will be noticed the defendants made no objection to Mr. Martin's new effort; they even asked him again to change the form of his action—to sue for damages as for a wrongful discharge; but Mr. Martin seemed to be still reluctant to say he would stand on that ground.

The new effort was begun and the trial proceeded:

OSCAR E. MORTON, EXAMINED BY MR. MASTEN:

I have done business in New York as a public accountant for ten years. At the request of Mr. Martin, I made examinations of the books of the W. J. Johnston Company in March and November, 1890. I examined all the general books—the ledger, cash book, journal, stock books and the other general books of the company.

Q. Are you able to state who the stockholders were of record at the time of your last examination in November, 1890, as shown by the stock books? A. W. J. Johnston, 2,280 shares; J. H. Johnston, five shares; W. T. Hunt, five shares; Frank E. Knight, five shares; T. C. Martin, 100 shares; C. E. Stump, five shares; the stock in the name of Mr. Martin stood in more than one certificate; there was a certificate of stock standing in his name for 80 shares.

Q. How was that receipted for upon the books?

Mr. Keigharn: I object to that.

The Referee: The objection is sustained.

Q. Are you able to state from your examination made in March, 1890, what the net profits were of the business of that company for the first half of the year 1889, and also for the second half of the same business year ending December 31st, 1889—if so, state what they were?

Mr. Keigharn: Would it not be more regular for him to state the gross earnings and disbursements, and not have the witness give his opinion as to the net earnings?

The Referee: I think the objection a proper one.

Q. Did you take from the books of the company an abstract or statement of the profit and loss account for the year 1889? A. I did.

Q. What, according to that statement taken from the books, were the total profits of the year 1889, as shown by the profit and loss account?

Mr. Keigharn: I object to that as irrelevant, immaterial and incompetent.

The Referee: The objection as to incompetency is sustained.

Q. Did you prepare as the result of your examination of the books of the company a profit and loss statement for the year 1889? A. I did.

Q. Is that the statement which I show you? A. It is, in my handwriting, prepared by me at the time from the general books of the company.

Q. Do the statements therein contained bear also upon the profit and loss account of the company? A. Yes.

Q. Is that statement correct? A. It is.

Mr. Masten: I now offer the statement in evidence.

Mr. Keigharn: I object to it as incompetent, and as merely secondary evidence.

The Referee: I shall be very slow to recognize a rule which will allow an expert accountant to go into a store and make an examination of books and then come and testify as to the result of his examination.

Mr. Keigharn: If Mr. Masten will intrust the memorandum to me I will compare it with our books, and if it is correct I will have no objection to having it offered in evidence. I will have it on Thursday morning.

Mr. Masten (to Witness): I will have to suspend your examination.

Mr. Morton recalled and examined by Mr. Masten:

Q. You may state if you will what you found from the profit and loss statement of the books of the W. J. Johnston Company to be the total gross profits for the year 1889? A. $136,493.92.

Q. What is the total gross amount under account of losses? A. $72,992.64.

Mr. Keigharn: What do you mean by losses?

Mr. Masten: What appears in the profit and loss account. (To Witness): What is the net amount remaining as profits? A. $63,501.28. The first half year was $32,961.59, and the second half was $30,539.69. For the half year ending June 30th, 1890, the gross profits were $78,376.71, the gross losses $45,377.55, leaving the net profits $32,999.16.

Mr. Masten: I offer in evidence the two statements.

CROSS-EXAMINATION BY MR. KEIGHARN:

Those memoranda of mine show the accounts at the time I examined the books in March and November, 1890.

Q. On each of those papers I notice what you call a salary account? A. Yes, sir.

Q. Do you know what that salary account was made up of? A. I have a pretty general idea now.

Q. Is it shown on the books from which you extracted this? Are the items shown? A. The items are shown on the cash book. There may be some items on the journal.

Q. Do you remember whether or not in the book you refer to, the names of the parties were given who received the salaries? A. To the best of my recollection they were.

Q. Are you able to recall whether there was any salary included in the loss account for the president of the company? A. To the best of my recollection there was not.

Q. Is there anything in the loss accounts showing bad debts? A. There is not.

Q. As an expert bookkeeper, I ask you, Mr. Morton, whether or not it is usual in such an account to include any items there may be in existence for bad debts? A. It is usual for a company or an individual doing a large business to write off his bad debts at certain times, if he has any.

Q. What is the practice about that—is it yearly? A. It differs according to the inclination of the company or individual.

Q. And you know that there was not any such item included here? A. To the best of my recollection there was not.

Q. Are you able to recall whether or not in those accounts there was any entry showing the amounts paid, respectively, to Mr. Wetzler, Mr. Hunt, Mr. Martin and Mr. Stump, of $2,500 a year? A. I have a recollection that such amounts were paid.

Q. Were they entered on the loss account on the books—the $2,500 that was paid in the way of a guaranteed dividend? A. I cannot state as to that $2,500.

Q. The amounts paid for salaries are included? A. Yes. But as to the others, I am not able to remember that.

Q. Do you recollect whether or not the amounts we have been speaking about were placed in a personal account of each of the gentlemen named? A. I think it was.

Q. If it was placed in a personal account it would not appear in the profit and loss? A. No; I think that would remain as an open balance.

Q. The last item you gave us here of a half yearly earning was ending June 30, 1890? A. Yes, sir.

Q. You don't know anything about the earnings for the other half of 1890? A. That half year hadn't closed at the time of my examination.

It is as difficult to understand why Mr. Morton was made a witness as why Mr. Colvin was. He showed nothing, so far as we can see, in aid of Mr. Martin's case. Three things, however, he did show:

The first is that he overhauled all the books of the company for Mr. Martin's special benefit in March and November, 1890, which fact verifies what we have already said as to Mr. Martin's knowledge of the condition of the business at the time he wrote the paragraph of June 22, 1892.

The second is that when Mr. Martin was paid the $2,500 in lieu of dividends for the one year he worked under his contract, no part of the profits to which he had any right was withheld from him. He was paid all he was entitled to and more than he would have been entitled to, according to Mr. Morton's figures if the amount had not been guaranteed and had been made to depend upon a yearly dividend fixed by the net earnings of the company.

The third is that Mr. Morton admits that the item of $10,000 paid as guaranteed dividends to Messrs. Martin, Wetzler, Hunt and Stump was not included in the profit and loss account, and consequently was not deducted by him in figuring out the net earnings.

Mr. Morton's cross-examination and this explanation make it apparent why Mr. Martin struggled to have Mr. Morton testify as to the gross amounts and to keep out of sight details.

Again Mr. Morton said the president of the company drew no salary. Why was he not entitled to salary? Messrs. Martin, Wetzler, Stump and Hunt got salaries for their work and drew their dividends besides. Why should not Mr. Johnston also get a salary for his work, and why should not such an item be taken from the gross profits? Mr. Morton also said nothing was allowed for bad debts. Some such item ought to have been substracted.

Mr. Martin accomplished nothing by Mr. Morton's evidence. It enabled us, however, to expose still further the true character of the paragraph he published.

THOMAS C. MARTIN, EXAMINED BY MR. MASTEN:

I am the plaintiff in this action. And one of the parties to the contract with Mr. W. J. Johnston, which is already in evidence. I was in the employ of the W. J. Johnston Company from its formation in 1889.

Q. Before the formation of the company you had been for some time in the employ of Mr. Johnston, the proprietor of The Electrical World? A. Yes, and even prior to that—before there was The Electrical World.

Mr. Masten: Did you receive in the early part of the year 1890 the 20 shares of stock which were to be delivered to you at the end of your first year's service under the contract which is in evidence? A. Yes.

Q. Are you still the holder of the certificate therefor? A. I have it.

Q. And have you no other stock of the company? A. Not in my possession.

Q. You have demanded it? A. Yes, sir, I have demanded it.

Q. Were you at one time in the Board of Directors of The W. J. Johnston Company? A. Yes, sir, I was vice-president of the company and a director.

Q. When did you cease to be a member of the board? A. After the annual election in 1890.

Q. At what time of the year? A. It was early in the latter half of February—the 19th or 20th, or something of that kind.

Q. Do you know the number of shares into which the capital stock of the company was divided? A. 2,500.

Q. What was the par value? A. $10 per share.

Q. So far as your knowledge goes, was the stock of that company at the time that you were on the board, or has it since been the subject of purchase and sale in open market? A. No, sir.

Q. A large majority of the stock is held by Mr. Johnston, is it not? A. About 99 per cent. of it.

Q. Who were during the time when you had any personal knowledge of the affairs of the company—who were the other stockholders beside Mr. Johnston? A. Mr. Stump, Mr. Hunt, Mr. Wetzler, Mr. J. H. Johnston, Mr. Knight, myself and two or three others I know of, but cannot mention—employees of the company.

Q. Who were these gentlemen? A. All employees of the company except Mr. J. H. Johnston, a jeweler.

Q. A relative by marriage of Mr. Johnston? A. Father-in-law.

Q. The other stockholders, then, were all employees of the company with his exception? A. Yes, sir.

Q. What income did you receive during the year 1889 from the 100 shares of stock which stand in your name on the books of the company? A. In the neighborhood of $2,500—that sum or thereabouts.

Q. When did you leave The W. J. Johnston Company's employ, Mr. Martin? A. On a Friday in March, I think it was the 5th or 6th.

Q. What was the occasion of your leaving? A. I was threatened with personal violence, ejectment.

Q. Were you discharged from the employ of the company? A. I presume that would be the name for it.

Q. By whom were you discharged? A. Mr. Johnston.

Q. Who was then the president? A. Yes, sir.

Q. Was he the officer under the by-laws empowered with the duty of employing and discharging help?

Mr. Keigharn: I object to that.

The Referee: Objection sustained.

Q. Was any reason given for your discharge at the time, either orally or otherwise? A. None whatever.

Q. During the time you were in the employ of the W. J. Johnston Company as editor of the World did you perform your duties to the best of your ability? A I did my level best.

Q. Did you give your entire working time to the service of the company? A. Yes, sir, day and night.

Q. Engaged in any outside affairs? A. Absolutely none.

Q. You were paid your salary, were you, up to the time of leaving by the company? A. I was paid up to either Thursday afternoon or Friday morning. I did not figure it out accurately. It was paid in small change.

Q. You have heard Mr. Morton's testimony to-day with regard to the examination of the books? A. Yes, sir.

Q. You authorized Mr. Morton as your representative to make that examination? A. I did.

Q. Have you since endeavored to obtain a further examination of the books? A. Yes, sir.

Q. Were you allowed to do so? A. No, sir.

Q. And when was that effort made? A. The last effort was made yesterday afternoon.

CROSS EXAMINATION BY MR. KEIGHARN.

Q. Prior to January, 1890, how long had you been in the employ of Mr. Johnston? A. I began to work for Mr. Johnston in the early part of 1883, on "The Operator." It may have been May, or it may have been June, somewhere around that time. And remained in Mr. Johnston's employ down to December, 1888, when he made the contract. Until the formation of the company.

Q. You were acting during all this time as editor-in-chief of the World? A. Not all the time. I think I became editor-in-chief toward the end of 1884.

Q. And from 1884 down to December, 1888, when the contract was made, you had sole charge of the editorial affairs of the World, hadn't you? A. I was the working editor, but Mr. Johnston's name was on the paper as editor. Is that what you want to get at?

Q. I want to know whether you were the one in charge, and had sole direction as editor, and were responsible? From 1884 to 1888, when you made the arrangements with Mr. Johnston, had you sole and exclusive charge of the affairs of the World? A. If you want to get at the responsibility, I was responsible.

Q. Immediately prior to entering into the contract with Mr. Johnston, in 1888, was there any trouble existing between you and him? A. None whatever.

Q. Was there any suggestion on your part to resign your position as editor of the World? A. Yes, sir.

Q. You had made up your mind to resign your posision? A. I had made it up absolutely.

Q. There was no active quarrel between you and Mr. Johnston, no disagreement? A. None whatever.

Q. And for the purpose of giving you some interest in the business, the W. J. Johnston Company was organized, was it not? A. The company was not formed to give me an interest in the business.

Defendants' Counsel: Will you answer my question if you can, and if you cannot, say so.

The Referee: It seems to me the question should have a direct answer.

Q. Were not you aware of the fact at the time it was organized that that was the object the promoters had in view—to give you and other employees of W. J. Johnston some interest in the business of The Electrical World? A. Yes, sir, to give me and the others.

Q. You were aware of that fact? A. Yes, sir.

Q. You remember the 5th of March, 1890? A. Will you tell what day of the week it was?

Q. Do you remember the day you received what is put in evidence as Exhibit 3—your discharge from Mr. Johnston's employment? A. Yes, sir.

Q. What time of the day was it handed to you? A. It was late in the afternoon—between five and six o'clock.

Q. Were you in the office when it reached you? A. Yes, sir.

Q. Who was it handed it to you? A. Frank Colvin.

Q. You had a bookkeeper in the office that day? A. No, sir.

Q. Had you the previous day? A. I don't think so.

Q. As a matter of fact was there a bookkeeper examining Mr. Johnston's books, or the books of the Johnston Company on the 5th of March? A. Not for me.

Q. I ask if you know as a matter of fact? A. I know as a matter of fact nobody examined the books for me.

Mr. Keigharn: Mr. Referee, I think he ought to answer.

The Referee (to witness): Make your answer a little broader. The question is, whether you knew the books were examined there for any purpose by anybody?

A. To my knowledge not by anybody.

Q. Was Mr. Wetzler in the office on the 5th of March?

Plaintiff's Counsel: I object.

Objection overruled.

Witness: He was during the day.

Q. Do you remember Mr. Wetzler having a bookkeeper there on March 5 examining the books? A. No.

Q. Quite positive? A. I am positive I cannot recollect.

Q. Did you have any conversation with the bookkeeper who was examining the books for Mr. Wetzler on March 5? A. I do not recollect any such occurrence.

Q. Had you any trouble with Mr. Johnston on the 5th of March, on the occasion I refer to?

Plaintiff's Counsel: Will you be a little more specific? I object to the form of the question, as too indefinite. Trouble means one thing in Kentucky and another here.

Referee: I think Mr. Martin knows what trouble means.

Witness: I cannot recollect any specific trouble.

Q. Do you recollect any general trouble—any trouble?

A. It was all trouble at that time.

Q. I refer to one day—won't you answer my question, yes or no? A. That is as far as I can remember it.

Q. You say positively that there was no trouble between you and Mr. Johnston on March 5, 1890?

The witness here hesitated.

Plaintiff's Counsel: There is no disposition on our part to decline to answer questions.

Referee: Mr. Martin, if you cannot recollect, say so.

Witness: The fact of it is, there was so much trouble I cannot recollect any specific trouble.

The Referee: Defendants' counsel has called to your mind a certain occasion when a letter of very peculiar import was delivered to you; the date is fixed as March 5, 1890; now, his question is, whether on the day that occurrence took place there was any trouble of any sort between you and Mr. Johnston?

Witness: I could not swear to the 5th. If you ask me something definite I will answer it.

The Referee: Leave out of view the date of the month and put your mind on the day on which that letter was delivered to you, whether 5th, 7th or 10th—was there any trouble between you and Mr. Johnston on that day?

Witness: Either that day or the day preceding. I am not sure which, there was trouble of a pronounced nature.

Mr. Keigharn: What was the trouble, Mr. Martin?

A. I endeavored to examine the check book.

Q. You endeavored to examine it? A. I did.

Q. What then? A. I went to Mr. Stump and asked him to give me access to the books as treasurer of the company. He did so, and placed the checkbook at my disposal. I proceeded to make an examination of it. I had it in my possession about a minute, possibly. Mr. Johnston came and deliberately snatched it from me.

Q. Who was present when Mr. Johnston came and endeavored to snatch it from you? A. Mr. Stump, Mr. Colvin and some of the people in the office.

Q. It was on the 5th of March that this occurred? A. I think that was the same day, I don't know positively.

Q. Are you willing to swear it was March 4 or 5?

Witness here paused.

Mr. Masten: Say to the best of your recollection.

Witness: According to the best of my recollection it must have been Thursday morning, about 11:30.

Q. Was it the 5th of March, or the same day you were discharged from Mr. Johnston's employment? A. Whose employment? I was not in his employment.

Q. Was it the day on which you received the discharge? A. I do not remember the day.

Mr. Masten: Try and answer the question, Mr. Martin.

Witness: It was the day I received that letter, I think

Q. When Mr. Johnston came and snatched the book out of your hand, did he say anything to you? A. Yes.

Q. What was it he said?

Plaintiff's Counsel: I object to this line of examination as irrelevant and immaterial. I don't know how it has anything to do with the performance of Mr. Martin's duties as editor of The Electrical World.

Objection overruled.

Q. Are you able to remember what he said? A. In a general way he said it was not my business.

Q. What was not your business; what do you refer to? A. To have access to the books of the company.

Q. What hour was it you were examining the books? A. It was in the forenoon—before lunch.

Q. Was there any quarrel through Mr. Johnston trying to take the book out of your hand? A. I had not seen Mr. Johnston, if I recollect aright, before that time.

Q. During the day did he request you to go into your own room—the editor's room—out of the general office? A. Yes, he did, while I was examining the books.

Q. What reply did you make to Mr. Johnston's request? A. I said that his refusal to present any balance sheet or to make any statement of what the business of the company had been, had compelled me to endeavor, as a stockholder, to find out for myself what the books contained, and I proposed to do so.

Q. Did you say anything else? A. I don't think so.

Q. You said in reply to his demand that you go to your own room, just exactly the words that you have spoken? A. Yes, in reply to that question.

Q. Was your answer just as full and as formal as you make it now? A. I think it was.

Q. After you made the reply you say you did, did you comply with the request and go to your room? A. Yes.

Q. How soon? A. I think in about two minutes.

Q. When Mr. Johnston asked you to go to the room did you reply that he could not order a partner into his room, or words of like purport?

Plaintiff's Counsel: I object to all this testimony.

Objection overruled.

A. I cannot recollect such phraseology.

Q. Did you add that you would go when you pleased? A. I cannot recollect such words.

Q. After you went to your own room, did you see Mr. Johnston again during the afternoon? A. I don't think so.

Q. How long after you had refused to go to your room was it Mr. Colvin handed you the letter of discharge? A. Late in the afternoon—very late.

So far Mr. Martin shows that he was responsible for the editorial management of the paper; that he had forgotten the fact that either he or Mr. Wetzler had a bookkeeper examining the books in the office of the company on March 5th; and had also forgotten some of the important incidents which occurred between him and Mr. Johnston on that day. He remembered, however, that he went to his room when Mr. Johnston requested him to do so, although Mr. Colvin swore that he did not go but "stood still and smiled." Mr. Colvin also remembered what Mr. Martin failed to remember—that there was a bookkeeper present examining the books.

Q. When did you say you ceased to be the vice-president of the Johnston company? A. Around February 20th, 1890—I am not quite sure.

Q. Prior to the annual election was not there considerable ill feeling on your part toward Mr. Johnston? A. There was considerable indignation on my part.

Q. Won't you answer my question?

Plaintiff's Counsel: How is it material in any way?

Defendants' Counsel: I think it is.

The Referee: Go on, Mr. Martin.

A. I felt a great deal of indignation toward Mr. Johnston for the treatment I was receiving at his hands.

Mr. Keigharn: I ask you to strike that out, Mr. Referee. I simply want the answer about the feeling.

The Referee: Strike it out. If he means ill feeling by indignation he can answer the question in the affirmative; if he doesn't mean ill feeling by indignation, he is speaking of something that is not asked about. (To witness)—The question is whether you had ill feeling?

Witness: Yes, sir.

Q. You were in the habit about that time of refusing to obey Mr. Johnston's directions? A. No, sir.

Q. You are quite sure about that? A. Quite sure.

Q. When Mr. Johnston made you suggestions in reference to editorial matters of the World, were you in the habit of acting upon them? A. Yes, sir.

Q. And treating them with respect? A. Yes, sir.

Q. Were there not occasions when you gave Mr. Johnston considerable impudence and insolence when he offered you suggestions? A. Never, sir.

Q. Did you ever write him anything which was insolent? A. I have written him.

Q. Did you ever write him anything which was impudent or insolent? A. Not that I consider so.

Q. You spoke about a threat of personal violence being used on March 5. Who was it used any threat of personal violence toward you? A. Mr. Johnston.

Q. What did the threat consist of? A. He said if I did not get out he would have me put out—he would bring in a policeman and have me ejected.

Q. What was the trouble which led up to the threats of violence which Mr. Johnston made on the 5th of March? A. I was in the business office of The Electrical World endeavoring to examine the checkbook. I had it in my possession about half a minute. I had no time to make any definite examination in that minute of a single entry. Mr. Johnston rushed out of his office and endeavored to snatch the book from me.

Q. Anything else? A. I endeavored to keep the book.

Q. You resisted Mr. Johnston? A. I resisted.

Q. How long was he engaged in the effort to take the book from you? A. It was quick work—five minutes.

Q. You had not seen Mr. Johnston that day prior to his effort to take away the book? A. I don't think so.

Q. When he made the attempt to take the book away from you he threatened to eject you by a policeman if you did not leave the office? A. It was the next morning that he threatened to eject.

Q. Did not this happen on the 5th? A. This episode occurred in the business office the day before he threatened to eject me.

Q. The effort to take away the book from you? A. Yes, sir.

Q. When was the threat to eject you? A. Next morning.

Q. On the 6th? A. Friday.

Q. When he threatened to eject you or have a policeman eject you what was taking place at the time? A. I had gone into Mr. Johnston's office to tender my services after getting that letter of the previous evening from him—the letter of discharge.

Q. What happened in Mr. Johnston's office? A. I made Mr. Johnston a formal tender of my services and asked to be allowed to do my work.

Q. What did Mr. Johnston say? A. He said that if I did not get out of the office he would throw me out—he would call in a policeman to eject me.

Q. Was there any quarrel of any kind between you at all when he threatened to call in a policeman? A. It was very quiet.

Q. Did he request you to go before he threatened to call in a policeman? A. Yes, Mr. Johnston came into my office that morning.

Q. I am speaking of what happened in Mr. Johnston's office? A. Nothing else occurred but just that.

Q. I ask you the question, if he did not when you tendered your services, and when he informed you your services were not required, request you to leave the office? A. His request took the shape of a threat.

Q. I asked you did he request you to leave the office—say yes or no. A. Yes.

Q. When he asked you to leave the office, Mr. Martin, you refused—is it not a fact? A. No, sir.

Q. Do you mean to tell us here that without any refusal on your part Mr. Johnston threatened to bring a policeman, and have you actually forced out? A. Mr. Johnston said he had given me notice of discharge, and that unless I got out, he would force me out.

Q. Before he said unless you got out he would force you out, did not you refuse to go when he asked you to leave the office? A. No, sir.

Q. Was Mr. Wetzler there? A. Yes.

Q. He made the same offer of his services as you? A. Yes.

Q. It is perfectly clear to you, Mr. Martin, that Mr. Johnston did not say anything in response to your tender of service except to threaten to have you put out by a policeman? A. That is exactly it.

Q. He did not ask you to go out peaceably, but merely made a threat blunt out? A. Blunt out.

Q. You say after you went out of Mr. Johnston's room,

you went into your own room? A. I do not understand saying any such thing.

Q. Didn't you say Mr. Johnston came to your room? A. That was previously.

Q. You came to work on the morning of the 6th as usual, after you had been discharged? A. Yes, sir.

Q. When Mr. Johnston came into your room what did he say to you? A. I think he asked me if I had received his letter of discharge?

Q. What did you say? A. I said I had.

Q. What did he say? A. He said to get out.

Q. How long after he asked you to get out did you remain in the office? A. It seems to me it must have been somewhere about an hour, the whole thing.

Q. After the lapse of an hour you came into his office then and offered your services? A. I think that was about the time.

Q. Then he told you to get out or he would have you put out by a policeman? A. Yes, sir.

Down to this point it was made to appear that Mr. Martin had ill feeling toward Mr. Johnston. He admitted this with reluctance. He says he always treated Mr. Johnston's wishes with respect and used no insolence or impudence toward him; that when Mr. Johnston tried to take away a checkbook, he resisted him.

What Mr. Martin has been referring to as threats of personal violence, and has been parading as something entitling him to sympathy, is made clear by this evidence. It appears that for a day or two after he was discharged he remained in the office, or came there occasionally, tendering his services. What his object could have been in doing this we do not know, unless he thought that Mr. Johnston would undo what he had done, and might make some overtures as to taking him back. However, after this tendering of services was kept up for some time, Mr. Johnston finally directed him to leave the office, and told him that unless he did so he would have him removed by a policeman. There was certainly no threat in this of any violence. It is funny in the extreme to think of Mr. Johnston contemplating committing an assault, and first calling in a policeman to witness it. It was a very proper course to get an officer of the law to remove Mr. Martin, when he would not go after being discharged and requested to leave. There is nothing in this story, when boiled down on cross-examination, which in any way shows that Mr. Johnston ever threatened or intended to commit any violence on Mr. Martin. If Mr. Martin was really afraid that the policeman when he came there would club him, Mr. Johnston would not have been responsible for that, even if anything so unfortunate had occurred, and we do not think that even Mr. Martin's ardent imagination could lead him to seriously believe that the policeman would assault him.

Q. You say Mr. Johnston gave you no reason at all for your discharge? A. Yes, sir, I do.

Q. Are you aware that there existed any reason for your discharge? A. I am not aware of any reason whatever.

Q. You cannot recall any lapse of duty or anything that would justify your discharge? A. No, sir, none whatever.

Q. I understood you to say in the last examination that you were employed by the Johnston company? A. That was my understanding of it, yes, sir.

Q. You don't say it was so? A. I say it was so.

Q. Was there any agreement between you and the Johnston company? A. No written agreement.

Q. Was there any verbal agreement? A. No, sir.

Q. You remember the issue of the World which bears the date of the 15th of February, 1890? A. Yes.

Q. It was put out in two forms, was it not? A. Yes.

Q. What was the regular press day? A. Monday.

Q. That issue had to go to press earlier than usual? A. Yes.

Q. You knew it was necessary to have the Feb. 15th issue go to press on Saturday, Feb. 8? A. We were trying to get it out on that day as being desirable.

Q. I ask you if you knew it wasn't necessary? A. I will admit it was necessary.

Q. As a matter of fact, was it issued on the 8th of February? A. Yes, sir.

Q. There was one issued, as I understand, on the 8th of February, and one issued on the Monday or Tuesday following—am I correct? A. On Monday following.

Q. In the edition which was issued on the 8th of Feb. there were no editorials, were there? A. No, sir.

Q. How, Mr. Martin, did it happen that it was issued without editorials? A. Mr. Johnston took the making up of the paper out of my hands.

Q. It was Mr. Johnston's fault? A. Yes, sir.

Q. What time of the day did Mr. Johnston take the paper out of your hands? A. Around five o'clock.

Q. In the evening? A. Yes.

Q. That was on Saturday, was not it? A. Yes.

Q. At five o'clock on the evening of Saturday you had written no editorials? A. Oh, yes, several.

Q. Had you them all ready? A. Yes.

Q. How long before that had you them ready? A. I began writing them about four o'clock.

Q. On Saturday evening? A. Yes.

Q. And had them all ready at five? A. My own, yes. There were some of Mr. Wetzler's, I had not.

Q. How many of the editorial notes which were published on the following Monday in the paper had you ready at five o'clock Saturday evening? A. Six or seven.

Q. How many of them had Mr. Wetzler written? A. About the same number, perhaps not quite so many.

Q. What did Mr. Johnston do to prevent you from putting the paper to press? A. He took it out of my hands.

Q. In what way? A. Around five o'clock we were working on the paper. Mr. Johnston came into the office and went around the stones, the composing stones, and looked at the state of affairs and spoke to Mr. Newman, the foreman, and went over to the hook on which we hung the proofs, snatched them off, and went to the desk that I occupied and sat down for may be a minute or two. He spoke to Mr. Newman and gave him some instructions, or what I took to be instructions. I went up and asked him what orders he was giving Mr. Newman. He would give me no orders. A little bit after that I went up to Mr. Johnston and asked him if he would give me some instructions as to the making-up of the paper, and finally a minute or two afterward I asked him if he would let me alone and finish my work.

Q. Why did you ask him that? A. Because he was giving orders all over the place.

Q. Was he interfering with you? A. It was a pretty good interference.

Q. You say you could not get any orders? A. No, sir.

Q. Orders as to what? A. Whether we should go on.

Q. And he would not give you any? A. He just skinned his teeth and leered at me, that was all.

Q. That was after five o'clock? A. Right on five.

Q. When did you leave the office? A. Within 10 minutes.

Q. You went away 10 minutes after five? A. Ten minutes after the thing began—about a quarter past five.

Q. How long had Mr. Johnston been in the office? A. Ten or fifteen minutes.

Q. How long had you been in the office that Saturday? A. Continuously.

Q. From about half past 10? A. Straight along.

Q. Mr. Wetzler was with you all the day? A. Except when he went out to lunch.

Q. You say you began to write your editorials about four o'clock, and you wrote six or seven, and Mr. Wetzber wrote about as many? A. Not quite as many.

Q. What were you doing all the day from half past 10 down to four? A. Working on the paper.

Q. In what respect? A. In every respect.

Q. Specify some of it? A. Writing notes, reading proofs, making up pages, writing captions, etc.

Q. Reading the proofs of what? A. Pages of the paper.

Q. Pages of reading matter? A. Yes.

Q. What was Mr. Wetzler doing? A. Similar work.

Q. Are you willing to swear that you read proofs on this Saturday, the 8th of February? A. Yes, sir.

Q. Are you willing to swear also that you read them from about ten o'clock till about four? A. Yes, certainly.

Q. You swear positively to that? A. Positively.

Q. How much of this very proof was put in type during the week?A. That's a guess, 60 or 70 per cent.

Q. When you got down to the hour of about four o'clock on Saturday, when you began to write your editorials, was there anything else lacking for the paper? A. There was matter being set which was necessary.

Q. What was it? A. A great deal of matter which I had written during the day, and out-of-town correspondence, Western articles and Eastern articles.

Q. During the day prior to four o'clock did you receive any communication from Mr. Johnston before he appeared in the office? A. I don't remember any.

Q. Are you quite positive? A. I don't remember any at all.

Q. Did any of the printers make any demand upon you at all to furnish them with any manuscript of your editorials earlier in the day? A. Not that I remember.

Q. It was generally known at the printing office that that paper had to go to press early on Saturday, to enable copies to be at the convention on Tuesday? A. Yes.

Q. Mr. Martin, according to you own story, and taking that as it is, what was your reason for deferring the preparation of your editorials until four o'clock? A. I did not defer it.

Q. I will change the question—why was it you had not written them before four o'clock? A. They were always the last thing written.

Q. Was it usual to defer writing until an hour before going to press? A. Sometimes 10 minutes before.

According to this testimony, Mr. Martin knew, and he admits it, that it was necessary to have the paper issued on Feb. 8th.

He admits that there were no editorials in the portion of the paper which was issued on Feb. 8, and says that this omission was Mr. Johnston's fault.

Without any hesitation he swore to this positively.

It will be worth while to bear this in mind, and to contrast it with the testimony of the other witnesses, Messrs. Kornfeld, Newman, Weithas, Smith and Wetzler, later on——not considering Mr. Johnston's testimony.

This contrast will probably show where the truth lies.

He also says that he and Mr. Wetzler wrote the editorial notes, some 13 or 14 in number, during the hour between four and five o'clock, and that these were all completed when Mr. Johnston came to the printing office at about five p. m., and further that the editorials were usually not written until an hour previous to going to press, and sometimes only 10 minutes before going to press. This presents a strange contrast with the testimony of Mr. Wetzler, who said it "might take him 3 hours sometimes to write one column of editorials.

Q. In the forenoon of the day did you receive a message from Mr. Johnston through Mr. Kornfeld? A. Not that I remember.

Q. You are not able to remember it at all? A. No.

Q. What time did you say Mr. Johnston came to the printers' office on Saturday? A. Around five o'clock.

Q. Do you remember receiving telephone messages from Mr. Johnston, or from some of the employees at Mr. Johnston's directions, during the 8th of February, or receiving them at Atkin's office where you were, as to whether or not the paper was going to press? A. I had telephone messages with Mr. Colvin.

Q. He was the only one? A. I do not recollect from any one else.

Q. Who was with Mr. Johnston when he came to Atkin's office? A. I don't remember, but I think Mr. Kornfeld.

Q. What did Mr. Johnston say to you when he went there? A. He did not say anything when he came in.

Q. Did he say nothing at all? A. Not immediately.

Q. You say that Mr. Johnston did not say anything immediately? How soon after he went into the office did he speak to you? A. He never spoke to me; no, sir.

Q. Did you see him after he went to the office go to Newman and ask Newman whether or not the paper was going to press? A. I don't know what he said to Mr. Newman; I know he went to him. I thought he was giving him instructions.

Q. Didn't you hear what he asked? A. I caught something about the paper going to press and took it to be in the nature of instructions.

Q. You didn't hear Mr. Newman's reply? A. I don't remember hearing.

Q. You didn't hear Newman reply that they hadn't got any editorials for the paper, and it was impossible to get it to press? A. I do not remember that.

Q. Did Mr. Johnston go and ask you what was the matter and why you hadn't your editorials? A. Mr. Johnston never spoke to me.

Q. Was Mr. Kornfeld present with him all the time he was there? A. I do not remember it.

Q. About 10 minutes after Mr. Johnston had been there you and Mr. Wetzler left the office? A. Ten or 15 minutes; a very short time.

Q. Mr. Johnston remained there? A. I don't know.

Q. He remained after you? A. He was there when I left.

Q. As you were leaving the office did Mr. Johnston make any request for you and Mr. Wetzler to remain and help to issue the paper? A. No, sir.

Q. You are quite positive? A. Yes, sir.

Q. Did not a word pass between you and him? A. No, sir.

Q. You did not even bid him time of day? A. He would not answer my questions.

Q. He must have been very angry, wasn't he? A. I don't know whether it was anger or the other thing; call it what you like.

Q. Just prior to your leaving the office, did Mr. Johnston ask you to remain and get the paper out and you reply: "No; we work regular hours, and it is usual to quit at five o'clock? A. I never said any such language; I never said any such nonsense.

Q. What was done afterward with the manuscripts of the editorials which you wrote between four and five o'clock? A. Done afterward—what do you mean?

Q. Were they destroyed, or are they in existence? A. God knows; the printing office keeps all the manuscripts.

Q. You didn't hand them to the printers before you went away at five o'clock? A. I believe I did.

Q. Are you positive about that? A. I believe I did.

Q. As you are not positive it will be impossible to say to whom you handed them? A. I think I handed them to Mr. Newman.

Q. You would not swear to that? A. I would not swear to it.

Q. As I understand, you say the reason you wrote no editorials before five o'clock was because you and Mr. Wetzler were busy all day? A. We were busy all day.

Q. You were actually engaged all the day on the paper? A. On the paper.

Q. During the day and about 11 o'clock did Mr. Weithas ask you to furnish editorial copy? A. No, sir.

Q. Did he speak to you at all about the issue of the paper? A. About the issue of the paper?

Q. Yes, in any way? What did he say? A. I don't recollect his exact words. I think he was kicking because things were dragging. That was my impression.

Q. Did you hear him say anything to Mr. Newman about it? A. No, sir.

Q. You say he did not say anything at all about the issue of the paper? A. I say that he did. He was kicking because things were dragging. He said that to me.

Q. What did he say? A. He said things were slow.

Q. Did he say to you this about 11 o'clock on February 8th: "Are you aware of the fact that there has been no editorial copy turned in, Mr. Martin?" A. I will swear he never said any such thing.

Q. He says you replied "I know it"; is that so? A. No sir.

Q. He did not say anything of the kind? A. I will swear to you that I had no conversation with Mr. Weithas about editorial at all.

Q. You will swear to that? A. I will swear to it.

Mr. Martin has now sworn that when Mr. Johnston came to the printing office Kornfeld was with him; that Mr. Johnston never spoke to him at all, and made no request either to him or to Wetzler to remain and get the paper out, and that he left the printing office about ten minutes after Mr. Johnston came. He will not say what he did with the editorials which he claims he had written. He says he would not like to swear to it, but thinks he gave them to Mr. Newman. He is positive he had his own written, and had some of Mr. Wetzler's in his possession that Weithas did not ask him for editorial copy.

When the testimony of Newman, Kornfeld and Weithas is published it will prove interesting reading in connection with this testimony of Mr. Martin.

Q. I find in the issue of Feb. 22, 1890, this telegram:

New York, Feb. 11, 1890.

"E. R. Weeks, President National Electric Light Association, Kansas City, Mo.:

"Sorry to be debarred from attenting the convention. The Association has our heartiest good wishes and will always have our best endeavor. May its deliberations be marked by Western breadth and Southern generosity, and may it grow as fast as Kansas City.

"T. C. Martin and Joseph Wetzler,
"Editors The Electrical World."

Will you just look at that and tell me whether or not you are the author of it? A. Yes, I am the author of it.

Q. What is the meaning of the expression "Sorry to be debarred from attending the Convention"? A. Meaning? It meant I was sorry not to be there, of course.

Q. It meant you were debarred from attending? A. It means what it says.

Q. Who debarred you? A. Mr. Johnston, I presume.

Q. You claimed or were under the impression that he prevented you from going there? A. Yes, sir.

Q. There was some quarrel, wasn't there, between you and him on the point of going there? A. Not about myself.

Q. Not about yourself? A. No, sir.

Q. About whom. A. About the editorial staff being represented there.

Q. It was a question whether you should go there or Mr. Johnston should himself? A. Oh, no; not at all.

Q. When you say you wanted the editorial staff represented, whom do you mean? A. I wanted Mr. Wetzler to go.

Q. And did you want to go? A. I did not want to go.

Q. And Mr. Johnston went? A. I believe he did.

Q. You and Mr. Johnston had some differences as to whether he should go or Wetzler? A. Not at all on that point.

Q. No dispute? A. Not as to whether he or Mr. Wetzler should go; none whatever.

Q. When Mr. Johnston made up his mind that he should go alone and Mr. Wetzler should not go, was not there some threat made on your part that you would bring his conduct to the notice of the board of Directors? A. I didn't make any threat; but I brought it.

Q. In what way was it brought? Did you move to have him censured? A. No, sir. I think I endeavored to get a resolution through the board that Mr. Wetzler should go, or that the editorial staff should be represented. I could not swear to it, but that was all that transpired.

Q. When Mr. Johnston went out there to Kansas City, do you know whether or not he left with Mr. Colvin any instructions as to issuing the paper on the following Monday? A. He left instructions with him.

Here the witness identified the following letter:

Feb. 10, 1890.

Dear Mr. Martin:

The following is a copy of a letter given to me on the train:

"New York, Feb. 8, 1890.

"To Mr. Atkin or to Whom it May Concern:

"Mr. F. R. Colvin has my authority to re-make up the Feb. 15th issue of The Electrical World, if he thinks best, or to make such changes in the paper as he sees fit; and to do anything else about the office as representing me.

(Sig.) W. J. Johnston, President."

Mr. Johnston, I know, would like the paper re-made up, the Editorial page added, and the list of those on the train printed somewhere in the paper.

I hope you will go ahead and get the paper out in its usual form, and I will render any assistance you may suggest. Very respectfully,

F. R. Colvin.

Rec'd at 9:30 a. m. Feb. 10, 1890.
T. C. Martin.
Jos. Wetzler, witness.

The witness also identified a letter written by him on the same date, Feb. 10, to Mr. Colvin, in reply, a fac simile of which appears on this page.

Q. How did you come to write this letter to Mr. Colvin? A. Mr. Colvin came to me on Monday morning about an hour after I had been in the office, and told me he had certain instructions from Mr. Johnston which he claimed invested him with full power to do everything in the office. I told Mr. Colvin that I was vice-president of the company, and in the absence of the other officers I was responsible, and I proposed to run it.

Q. When you wrote this letter you had the letter of Johnston to Colvin before you? A. I don't think so. He showed it to me; I don't know whether I had it before me or not. He made a demand on me, if I recollect aright, and I asked him to put it in writing, and thereupon wrote my answer. I think that was the course of events.

Q. As a matter of fact, the note which you received from Mr. Colvin contains a copy of the note from Mr. Johnston? A. What purports to be a copy. That I presume was what I had before me.

A word or two about these letters may not be out of place here. When leaving for Kansas City Mr. Johnston, not being certain that Mr. Martin would return to his post as editor of the paper, left instructions with Mr. Colvin to see that a sufficient number of copies were issued as early on Monday as possible to comply with the subscription lists. He also gave him a letter directing the printing office to carry out any request which Mr. Colvin might make. Somewhat to Mr. Colvin's surprise, as the letter which he wrote to Mr. Martin shows, Mr. Martin appeared at the office as usual Monday morning. In communicating Mr. Johnston's instructions to him Mr. Colvin added the letter written by himself. This note was apparently received by Mr. Martin with some ceremony; first he recorded on the bottom of it the day, hour and minute it reached him, and had this attested to by "Jos. Wetzler, witness." Mr. M.'s mind's eye must at that moment have been looking into the future.

To this polite note, which was nothing more than the expression of a hope on Mr. Colvin's part that Mr. Martin would go ahead and issue the paper, Mr. Martin returned the above extraordinary reply. This reply is quite characteristic of what we have no doubt were Mr. Martin's feelings at this time.. From a man who, hardly 48 hours before he wrote this bellicose letter, as will be seen by his testimony later on, was so absolutely helpless that he did not dare to undertake the responsibility of ordering a few printers to remain and work overtime to enable him to put his paper to press, when he knew it was all important to the interests of that paper it should go to press, he became on this Monday morning an individual clothed with powers almost autocratic in their nature. He impressed upon poor Mr. Colvin in a manner that was actually terrifying that he, Mr. Martin, was the vice-president of the W. J. Johnston Company, and, in substance, that Mr. Colvin must not do anything outside of sneezing and coughing and lunching of which Mr. Martin was not fully and explicitly informed. This letter was not written for the purpose of conveying to Mr. Colvin the intelligence that Mr. Martin was the vice-president of the company. Mr. Colvin already knew that fact; and the manner in which he addressed Mr. Martin, especially after Mr. Martin's strange conduct on the Saturday evening before, was creditable not only to Mr. Colvin's business judgment, but also to his recognition of Mr. Martin's superior position in the office. Nor was it written for the purpose of seriously requesting Mr. Colvin to do anything. It was written as a little childish display of the authority with which Mr. Johnston had clothed him, and for the purpose of showing, as he thought he could then safely show, in Johnston's absence, the contempt he had for Mr. Johnston's instructions.

New York Feb 10 1890

F. R. Colvin Esq
"The Electrical World" N.Y.

Dear Sir

I am in receipt of your favor of this date, advising me of certain instructions you have received from Mr. W. J. Johnston, as to the issue of the Electrical World of this week

In reply I would say, though it is hardly necessary, that in the course of a seven years' connection with the paper, I have never yet failed in any duty to it, and I certainly should not do so now

Your instructions, therefore, are not only void, but idle.

That, however, is beside the matter. I hereby beg to inform you that by the by-laws of the W. J. Johnston Company Limited, of which I am Vice President, I am vested with all powers in the absence of the President, and that I propose to exercise them to the full, for the welfare of the business

You will, therefore, submit to me, for initiative, all matters upon which action or decision is necessary, including the disposal of all correspondence.

You will not send any letter or telegram on business of the Company or paper, without my knowledge, consent and signature. I shall hold you strictly responsible for carrying out these explicit orders.

Yours very truly,
T. C. Martin
Vice President
The W. J. Johnston Company
Limited

"That Mr. Colvin must not do anything outside of sneezing and coughing and lunching of which Mr. Martin was not fully and explicitly informed."

The witness claimed he could not produce the original of the following letter, containing instructions regarding the issue of The Electrical World dated March 1, 1890, a press copy of which was shown him:

New York, Feb. 21, 1890.

Thomas C. Martin, Esq.:

Dear Sir: I desire that the next issue of The Electrical World shall be ready to go to press early Monday afternoon. Please see that all the matter for it is turned in and that the paper is "made up" in time for me to see the page proofs at not later than 3 p. m. on that day—Monday, Feb. 26, 1890, without fail.

Very truly yours,
W. J. Johnston.

He identified, however, his own letter of the same date, a fac simile of which apears on this page. This letter the defendants claim was his answer to the letter he failed to produce

After reading this answer, he still persisted in saying he failed to remember so as to justify him in admitting that the copy which was shown him was a copy of the letter he received from Mr. Johnston, and which called forth his reply of Feb. 21, 1890.

Q. Now, Mr. Martin, can you recall receiving this letter of Mr. Johnston's dated Feb. 21, 1890, of which I have shown you a press copy? A. I cannot.

Q. Can you recall receiving any instructions from Mr. Johnston as to the issue of the paper of March 1? A. I have no positive recollection about instructions.

Q. After reading this letter of yours, also dated Feb. 21, are you still unable to recall any instructions received from Mr. Johnston as to the issue of the paper? A. I have no positive recollection.

Q. Have you any recollection? A. I cannot fix it in my mind.

Q. Are you able to recall anything? A. No, sir.

Q. Kindly look at this letter and tell me what caused you to write it to Mr. Johnston? A. I don't know.

Q. After reading it over, Mr. Martin, you are not able to recall why you wrote such a letter? A. No, sir, I cannot say that I am; it was for some reason, but I have forgotten it.

Q. I will ask you whether or not you wish in any way to explain why you wrote it? A. I do wish to explain, but for the life of me I cannot remember what.

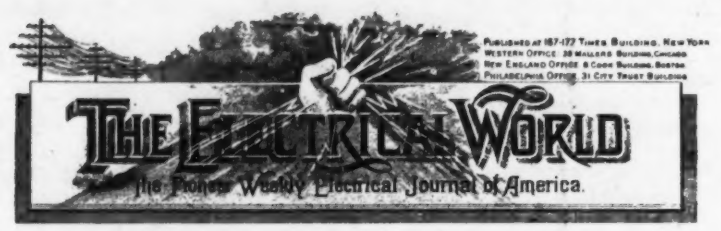
Q. You have no explanation to offer? A. Not at present. A. Not at present.

This was Mr. Martin's response to some letter of Mr. Johnston, apparently to the one Mr. Martin was asked to produce, which he claimed he could not find, and would not admit, from the copy shown him, that he had received.

As will be noticed from his testimony, Mr. Martin swears that he cannot explain why he wrote this letter nor give any explanation as to its contents. It is evident, from its contents, that all Mr. Johnston wrote requesting him to do was to allow him to see proof pages of the paper for the issue of March 1.

This was not a very objectionable request on Mr. Johnston's part, especially in view of Mr. Martin's strange conduct in connection with the issue of two weeks previous. Yet it evidently stirred Mr. Martin up, as it moved him to reply in a way which indicates he was angry. We would suppose that Mr. Johnston's letter and also his own reply made an impression upon him. Still, in his own strong language, "for the life of him he could not remember it."

The letter to Mr. Colvin and also the letter to Mr. Johnston, both of which we reproduce in fac-simile in this issue, were written by the same Mr. Martin, who had testified under oath that he always treated Mr. Johnston's wishes with respect, and had written him nothing which was impudent or insolent.


THE ELECTRICAL WORLD
The Pioneer Weekly Electrical Journal of America.
Issued every Saturday by
THE W. J. JOHNSTON COMPANY, LIMITED.

New York Feb 21 1890

W J Johnston Esq.

Sir. I am in receipt of what I assume are intended as instructions as to the time at which you want to have the paper made up and clean proof submitted— namely 3-pm. Monday afternoon

In reply I will say that in the presence of Mr. T. E. Knight I have already, though quite needlessly I am now, stated that you shall have the page proofs as soon as they are revised and ready. The usual time, as you can easily ascertain by inquiring at the printing office, is 5.30 to 6 pm.; but if they are ready before, I shall, of course, be only too glad to let you see them earlier

I further advise you that in case you interfere with me or harass me again, in the faithful performance of my duties, I shall hold you to the consequences. I am sorry you should compel me to put it this way, but I have no alternative.

Yours resp'y.
T. C. Martin
Editor.

MR. KEIGHARN: "Did you ever write Mr. Johnston anything which was impudent or insolent?" MR. MARTIN: "Not that I consider so."

Anything which came from Mr. Johnston at this time seems to have had on Mr. Martin the same effect as the proverbial red rag on the infuriated bull.

That his letters were intended as an insult to Mr. Johnston is shown by Mr. Martin's own evidence. When he was forced to admit that he had ill-feelings all this time toward Mr. Johnston, he was asked if he ever gave expression to these feelings, and he unguardedly, but very promptly, replied that he did in letters and protests. These letters are, we suppose, the letters which he had in mind when he gave this answer.

But the bravado, the brag and the insolence which these letters display is in singular contrast with the spirit of humility and submissiveness which he exhibited when he was under cross-examination, where he declared he was always "submissive," "always treated Mr. Johnston with respect," "never was impudent or insolent." When it suited Mr. Martin's purposes to be mild-mannered he could bottle up all his wrath and keep it securely corked, as his testimonuy shows.

An Automatic Telephone Exchange.

The Dallas (Tex.) "News" says that the Wichita Falls, Tex., automatic telephone exchange has been completed and is in full operation with 40 subscribers. In this telephone system there is no central office. Each subscriber makes his own connection with any other. The instruments look like the ordinary familiar office telephones, except that a neatly polished box, about 10 inches long by 4 wide, projects from beneath the transmitter, having on its face 18 small keyholes, distinguished by the letters of the alphabet. This is the automatic switchboard. A key, attached to a small brass chain, is normally inserted in X, but may be used in any of the keyholes. The lettered keyholes represent the different wires, or circuits, as they are called in the exchange. Each wire carries three subscribers, who have each a certain number of rings for a distinguishing signal. Connections are made by taking the key from X and inserting it in the keyhole which represents the wire wanted. When this is done the telephone receiver is taken down and applied to the ear to ascertain if the line is in use. With the receiver still held to the ear the proper signal is given and the connection is complete as soon as the party signaled takes down his telephone receiver. The system is intended for exchanges of but 60 or 70 subcribers, though it has been successfully used for larger numbers, not exceeding 100. It can be used in cities and towns where the central office plan cannot be profitably maintained. It is said to be giving excellent service at Wichita Falls, and the citizens are proud of it.

A New Method for the Control of Electric Energy.

A paper with the above very broad title was read before the American Institute of Electrical Engineers, Sept. 20, 1893, by D. McFarlan Moore. The author states that "there is reason to believe that this paper treats of a hitherto uninvestigated branch of electrical science and phenomena, which may be of great value to the commercial world," and that "the key to this branch of science may be expressed in a few words, viz., a varying-in-pressure contact in a vacuum, produced by a variable magnetic field."

The device described consists of an exhaust receiver, an armature secured to a spring, and a magnet which can be approached to or receded from the receiver and armature; an electrical circuit is made or broken by the vibration of the spring and armature, thereby producing interruptions or pulsations of the current in the circuit, but it is not plain how the "varying-in-pressure" contact principle enters. The rate of these interruptions or pulsations is controlled by varying the distance of the magnet from the armature.

The author says that tests showed that the amount of light in lamps controlled by this device varied directly with the volts and amperes, and that as the contacts are in a high vacuum they will remain bright and effective and the longevity of the lamp increased on account of the current not being thrown on and off the filament suddenly; also, that an "automatic make-and-break or varying-in-pressure contact, or what has commonly been called, and what has long been sought after, a scientifically formed 'poor or imperfect contact' can be used in one sense as a transformer

This device with the direct or alternating low tension current, it is claimed by the author, produces phosphorescent light. The is no objection, he says, to using high voltages; the effect is simply increased, as the greater the stress between the terminals and the more intense the magnetic field the more rapid will be the interruptions of the current; and the greater the number of impacts per unit of time the more intense the heating effect and the more economical the light will be. The most economical potential, he states, for any given electrodes can only be found by trial, because the greater the heat the less the permanency of the vacuum. The phosphorescence is, probably, according to the author, in a meas-

ure at least caused by the atomic disturbance due to the actual mechanical movement of the armature in the vacuum—the impacts and the static electricity that may be caused thereby in conjunction with the rapid disruptive discharges. This disturbance or action of varying electrostatic force consists, the author states, in the rapidly moving or vibrating of charged atoms or molecules coming violently in contact with one another, producing friction, heat and light. In fact, the generation of light due to friction within or without a bulb containing rarefied gas, and caused by inductive action, is a subject of much interest. Experiment seems to indicate that the amount of phosphorescence depends more on the number of contacts in different parts of the vacuum per unit of time than on the influence of a surrounding magnetic field. By reason of the inclosed space in which miniature incandescent arcs can be made to occur in rapid ture incandescent arcs can be made to occur in rapid succession throughout its extent the heat resulting therefrom is conserved, and aids in accomplishing the result sought for—a luminosity of maximum radiation emanating from a source of considerable area.

A number of variations of the devices are shown in cuts in the paper, which, however, appear to be merely suggestions rather than representations of actual experimental or practical forms.

NEW BOOK.

CATALOGUE OF "A. L. A." LIBRARY. 5,000 VOLUMES FOR A POPULAR LIBRARY SELECTED BY THE AMERICAN LIBRARY ASSOCIATION AND SHOWN AT THE WORLD'S COLUMBIAN EXPOSITION. Washington: U. S. Bureau of Education, 1893. 260 pages.

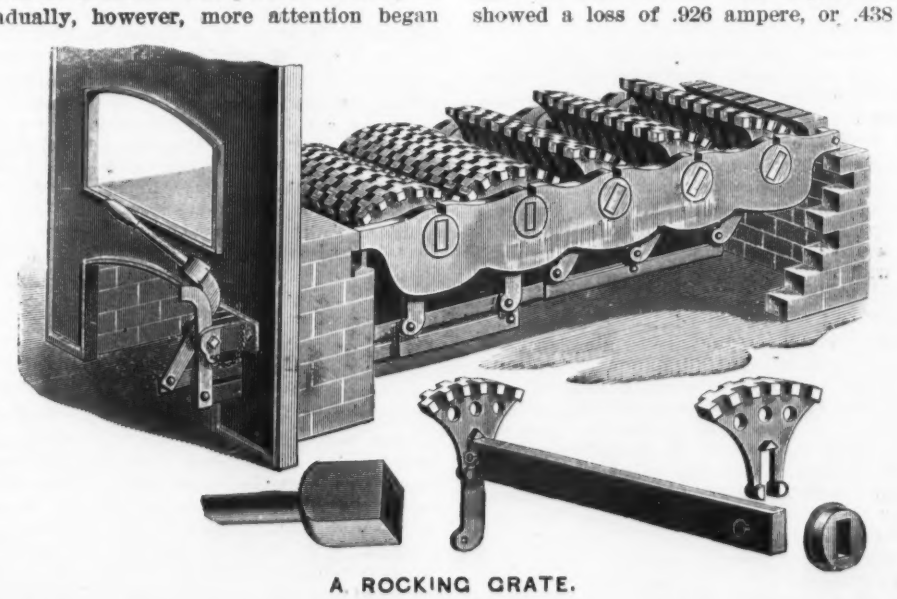
The 36 electrical books in this catalogue are very well selected from a technical standpoint, with a few exceptions, but as the library is intended to serve as a model one for small towns it is doubtful if the majority of the books are not entirely too advanced for such a purpose. For example, the higher treatises of Gray and Maxwell, which are included, are beyond the grasp of most college graduates, while those of Fleming, Kempe, Blakesley, Faraday and Tyndall are by no means within the reach of most electricians, though the two latter contain no mathematics.

Two of the works given are practically obsolete, three are mere commercial compilations, and two others are not the best selections of their class, while Tyndall's "Diamagnetism and Magne-Crystallic Action" is a special work even to physicists.

Of the omissions we note Gordon's "Physical Treatise on Electricity," Ayrton's "Practical Electricity," "Fleming's "Short Lectures to Artisans," Houston's Primers, Plante's "Storage of Electrical Energy," Slingo and Brooker's "Electrical Engineering," Gordon's "Decorative Electricity," "Preece and Maier's "Telephone," to which may, perhaps, be added Urquhart's elementary technical treatises, Sloane's "Electric Toy Making," and Niblett's "Storage Batteries," as works easily read. The substitution or addition of these works and several more that could be named might detract from the highly scientific character of the selection, but would add largely to its value to the mass of readers.

A Rocking Grate.

In the first days of electric lighting and street railways but little or no attention was paid to economy of operation. Gradually, however, more attention began to be given to engineering details; more economical engines were installed with later plants, and condensers were used where possible, but the boiler has not yet received the attention that it should. That there is a great saving from furnaces the doors of which do not need to be continually opened to manipulate the fires has been shown by many experiments, and it is probably only a question of time when all furnaces will be equipped with grates that will give the fireman full control of his fire without opening the furnace doors, thereby not only increasing the capacity of the boiler, but also reducing the fire-room force.



A ROCKING GRATE.

We illustrate a shaking and dumping grate manufactured by Hine & Robertson, 57 Cortlandt street, New York, and known as the Robertson Common Sense shaking and dumping grate bars. The manufacturers claim for it great durability in all its parts and simplicity of construction and operation.

The frame is strong and bolted together at each end, and the cross bars work in trunnions, making them travel easily with each movement of the lever. The bars being oval, there are no dead centres to hold the ashes and deaden the fire; being in separate pieces, they weigh but about three pounds, and are interchangeable and can be replaced at trifling cost without disturbing the grate. Large air space is secured from the peculiar shape of the bar. The entire grate is divided into two sections, which, working independently or together with one lever, thus gives the fireman an opportunity to clean his fire thoroughly without waste of coal.

An Important Electric Railway Trial.

The managers of the Intramural Railway at the World's Fair have for some time felt that trains much heavier and longer than ordinary lines could be operated and recently made a trial to prove that this was the fact. W. E. Baker, manager of the road, late at night started out a train composed of one live motor car, two still motor cars and nine empty cars, weighing in all about 196 tons. This heavy train was pulled along apparently without effort, even when it turned the loops at either end of the road, each of which has a radius of over 100 feet. On the following day, which was Railroad Day, invitations were issued to the railroad magnates assembled at the Exposition, and a train of eight cars (one motor car and seven trailers) was provided. The train was loaded to its fullest capacity, no less than 800 persons being carried. The motors ran smoothly at their maximum speed, and the test was satisfactory in every respect. The weight of the train can be conservatively estimated at 212½ tons. This performance may be compared favorably with that on any steam elevated railroad, and speaks well of the confidence of the managers in their road and its equipment.

Tests of a Street Railway Conduit System.

In our issue of July 1, 1893, we described an electric conduit system in experimental operation at Coney Island, and several weeks ago referred to a test there made, during which the road was operated with the conduit practically filled with mud and water. Mr. E. W. Stevenson, the electrician of the Brush Electric Illuminating Company, of New York, has reported upon this test, and from his report we are permitted to abstract the following:

Seventy-five feet of the conduit was pumped full of water previous to the test, and with a Weston ammeter and voltmeter the leakage was hardly discernible. In the length tested 12 boxes were included, and it is therefore safe to assume that the entire loss was only from these boxes, as a number of dry boxes tested showed no leakage whatever. Delicate measurements showed that the loss in this instance was .0058 ampere, or .0027 h. p.; it therefore would take 4,484 boxes entirely submerged to give a loss of 2.113 amperes, or one h. p.; and, as the boxes are six feet apart, this is equivalent to 5.09 miles of track.

The car standing with the shoe entirely submerged and the switches of two adjacent boxes turned on showed a loss of .926 ampere, or .438 h. p. As each car takes about 12 amperes, or 5.68 h. p. on an ordinary track, it follows that the loss amounts to 7.7 per cent., or, expressed differently, 13 cars placed in the same condition, would lose about the amount of power required to drive one car.

Motor-Generators for Sub-Stations.

The Popp Company, of Paris, is modifying its system of electric distribution in that city. Up to the present it charged accumulators in sub-stations from the centre stations of Boulevard, Richard Lenoir and Saint Fargeau, but it is now replacing the accumulators by motor-generators, formed of two dynamos mounted on the same shaft. There is being installed now in Rue Saint Roch, a sub-station which will contain 20 motor-generators of 30 kw. each.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

NEW YORK, Sept. 30, 1893.

THE ELECTRICAL STOCK MARKET has not as yet responded with that degree of activity that the improved and healthy condition of the electrical trade presaged. The failure of electrical stocks to advance with anything like the rapidity that the bettered state of affairs warranted is explained to some degree by the fact that operating and manufacturing companies find it still a matter of some hard work to obtain from the banks the credit and accommodation that their business character entitles them to, and by reason of this forced lack of working funds they have been compelled to curtail operations in many instances where there were splendid opportunities for increasing their earning capacity. It is on this account that the trade still hears of cutting down of salaries and of working forces. The General Electric shops, at Lynn, have cut down by 10 per cent. the wages of some of their employees, and a big cut in the salaries of other employees has been mad, the better-paying positions being particularly affected by this enforced economy. Many of the minor companies are still more affected by the continued stringency of money. This lack of funds cannot, however, continue long. The monetary situation at this centre is daily improving. The supply of funds is steadily increasing with the contributions from interior sources.

GENERAL ELECTRIC furnishes enough food for gossip to keep all Wall street busy guessing as to what nature the next report concerning the company will be. The next dividend, the resignation of important directors, the bankruptcy of the corporation, the threatened dissolution of the whole concern are all matters that have engaged Wall street's attention for the past week. Varying confidence has, of course, been given to the reports. The dividend question is of the greatest interest, and the decline of the week is chiefly on account of the now generally credited report that the stock is off, for the present any way, the dividend list. It was expected that the directors would make formal announcement to this effect at a meeting held yesterday, in Boston, but no definite action was made public, if any at all was taken on the matter. The point is made that one of the chief reasons General Electric does not go down more is the fact that too many people are bearish on it. There are enough discrediting reports circulated to warrant far more serious declines in the stock than have occurred, but the unwillingness of the big short interest prevents the bears taking full advantage of their opportunities. To give an example of how desperate the efforts are to hurt the company it was freely stated yesterday that "an important independent syndicate has been formed with a capital of $2,000,000 in the electrical business in which two large capitalists are concerned. It is understood that D. O. Mills will resign from the board of the General Electric Company in connection with this syndicate." The emphatic denials by Mr. Mills and by others that capitalists indentified with the company contemplate starting an opposition corporation put a quietus to this report as effectually as the fact that the turning in of 40 per cent. of their subscriptions gave a denial to the story current in the early days of the week that the syndicate subscribing to the floating debt liquidating scheme had been disrupted. President Coffin is authority for the statement that the scheme to pay off the floating debt will go through successfully. There is no reason to question the ability of subscribers to pay the remaining 60 per cent.; they are all men of vast wealth and are particularly interested, by reason of their large holdings of stock, in getting the company firmly on its feet. The chief trouble with the General Electric Company is that nobody except insiders is acquainted with its actual condition. It is for this reason that reports reflecting upon its financial condition meet with such ready credence. If the directors of the company would but deal frankly with stockholders and let them immediately know the worst when anything untoward occurs, then people would be more likely to truly gauge the possible effects of disturbing factors. There is no disposition to criticise specific acts of management; the general policy of keeping company affairs for the secret edification of insiders is wrong and is most calculated to inspire the current distrust. Wall street talks of reorganization of the company, of continued passage of dividends, of dismemberment. The Stock Exchange would discount these things with more fairness did it know the truth. And besides stockholders have a right to know the truth as to what the officials they have elected are doing with their trust.

WESTINGHOUSE ELECTRIC matters progress with the same steadiness and the same lack of unusual incident that has marked its course all along. The officers report steady business and the strength of the stock reflects the confident way in which shareholders are disposed to believe what the directors and managing officials of the company are disposed to tell them.

WESTERN UNION TELEGRAPH stock has suffered somewhat this week from large realizing sales. There seems to be a determination on the part of some one never to let the stock get above current prices, and the big bear operator who is credited with most of the manipulation in the stock is very free in his short sales whenever the stock gets to 80 or above. The company's officials are making desperate efforts to make up for the diminished volume of business, but with very little success so far. Actual earnings are understood to be far below estimated revenues. It was predicted in these columns that the actual revenue for the Sept. 30 quarter would fall as much below the estimated revenue as the calculation for the June quarter was. If this proves true, the company is just about earning the five per cent. it pays as yearly dividends on its $96,000,000 stock outstanding. There are hints of a possible early sale of the $4,000,000 treasury stock, making the capital outstanding the authorized $100,000,000.

THE LONG DISTANCE TELEPHONE COMPANY reports that, by reason of the commercial depression, its business has recently shown a very considerable falling off.

THE AMERICAN BELL TELEPHONE COMPANY is also affected by the business depression. It reports that the gross output of telephones for the month ending Sept. 20 decreased 3,631; there were, moreover, 1,843 instruments returned, making the net loss for the month 5,474. Since Dec. 20 last the net loss of instruments in use has been 11,982.

THE CENTRAL AND SOUTH AMERICAN TELEGRAPH COMPANY has declared its regular quarterly dividend of one and three-quarters per cent., payable Oct. 3 next. The troubles in Argentine and at Rio Janeiro have affected the company's revenue to some extent, but President Scrymser states that the loss of business has by no means been such as to threaten the dividend prospects of the company. There is, add officials, a comfortable sum left after paying the present dividend. The payment is made from the net earnings up to Sept. 30.

THE MEXICAN TELEGRAPHIC COMPANY has also declared a quarterly dividend of two and a half per cent. from the net earnings of the company to Sept. 30, payable on and after Oct. 10. An unusual degree of prosperity is reported.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	20	40
Detroit Electrical Works	10	2	3
East River Electric Light	100	..	65
Electric Con. & Supply Co. pref.	15	15	16
" " " " " com	15	15	17½
Edison Electric Ill., New York	.	94	98
" " " 1sts	...	102	103
Edison Electric Ill., Brooklyn	100	95	100
" " " Boston	100	120	125
" " " Chicago	100	220	230
" " " Philadelphia	100	120	125
Edison Electric Light of Europe	..	2½	5
" Bonds	..	80	85
" Ore Milling	..	5	12
Fort Wayne Electric	..	5	5½
General Electric Company	100	40¾	42
" " deb. 5's	..	78	80
Interior Conduit and Ins. Co	100	25	35
Mount Morris Electric	..	..	65
Westinghouse Consolidated	50	22	23
" " pfd	50	42	43

AFFAIRS OF THE COMPANIES.

THE BOSTON BELTING COMPANY, Boston, Mass., has declared its regular quarterly dividend of two per cent., payable Oct. 2.

THE BOSTON ELECTRIC LIGHT COMPANY, Boston, Mass., has declared its regular quarterly dividend of two per cent., payable Oct. 14.

THE AMERICAN BELL TELEPHONE COMPANY, Boston, Mass., has declared its regular quarterly dividend of three per cent., payable Oct. 16.

THE EDISON ELECTRIC LIGHT AND POWER COMPANY, of Kansas City, Mo., has filed articles increasing its capital stock from $225,000 to $280,000.

FORT WAYNE TRUST SECURITIES, SERIES A.—A dividend of 16 cents per share will be paid on Oct. 2, 1893, to stockholders of record at close of business Sept. 28.

THE DETROIT ELECTRIC WORKS is now being operated in the name of Hugh McMillan, and it is generally believed that he constitutes the "syndicate" that was reported to have secured control of the property.

THE NORTHWESTERN GENERAL ELECTRIC COMPANY, of St. Paul, has filed its annual statement. The capital stock is $1,500,000, of which $856,500 is paid up, while the balance is represented in territorial rights, franchises, merchandise and accounts.

THE BRUSH ELECTRIC LIGHT AND POWER COMPANY, of Savannah, Ga., was capitalized at $250,000 on Sept. 18, and absorbed the People's Electric Light and Power Company, recently established in connection with the Electric Railway Company, which promised to be a powerful rival to the old company. The deal was effected by an exchange of stock.

THE UNION ELECTRIC LIGHT AND POWER COMPANY, of Lansingburgh, N. Y., and the Waterford Electric Light and Power Company were consolidated last February, and in July the entire plant of the Green Island Electric Company, Albany county, N. Y., was purchased. The officers of the Union Electric Light and Power Company, of Green Island, N. Y., now are: Wm. M. Lea, president; J. Stanford Brown, general manager; H. W. Hamblin, superintendent.

NEW INCORPORATIONS.

THE NATCHEZ LIGHT, POWER AND TRANSIT COMPANY, of Natchez, Miss., has been incorporated with Abraham Moses as secretary and treasurer, and Maurice Moses as president.

BEVIER ELECTRIC LIGHT COMPANY, Bevier, Mo., capital stock $15,000, has been formed to erect an electric light plant. J. A. Bovard, J. H. Bovard and J. C. Stearns, Kansas City, Me., are the promoters.

THE EDINBORO & ERIE RAILROAD COMPANY, Erie, Pa., capital stock $200,000, has been formed to build and operate an electric railway. H. P. Van Dusen, C. S. Curtice and Geo. W. Fuller are interested parties.

HICKS-TROY ELECTRIC DOOR COMPANY, Chicago, Ill. capital stock $250,000, has been formed to manufacture and deal in electric doors and devices. Oliver H. Hicks, Robertus F. Troy and Robert McMurdy, are the promoters.

THE WABASKA ELECTRIC COMPANY, Wymore, Neb., capital stock $25,000, has been formed to construct electric light, power and other electrical plants in Nebraska. A. Stewart, S. D. Rengler and H. C. Van Buskirk are the incorporators.

THE CUMBERLAND VALLEY ELECTRIC PASSENGER RAILWAY COMPANY, Altoona, Pa., capital stock $300,000, has been formed to construct and operate an electric railway. The promoters are O. H. Ormsby, W. J. Ickes and Sam. H. Wigton.

THE CITIZENS' ELECTRIC LIGHT, HEAT AND POWER COMPANY, Lykens, Pa., capital stock $10,000, has been incorporated to supply light, heat and power to the town of Lykens. The promoters are J. B. Whitney, F. J. Douden and J. J. Nutt.

THE JOHNSON SUB-TROLLEY COMPANY, New York, capital stock $25,000, has been formed to supply the various parts used in electric railways. E. H. Johnson, E. H. Lewis, 44 Broad street, and C. H. Coster, 23 Wall street, New York, are the promoters.

THE CAPITOL ELECTRIC COMPANY, Hartford, Conn., capital stock $2,000, has been formed to buy, sell and deal in electrical supplies of all kinds and descriptions, etc. E. C. Wilcox, Meriden; L. F. Furlong and Joseph P. Tuttle, Hartford, Conn., are interested.

THE NORRISTOWN, BRIDGEPORT AND CONSHOHOCKEN TRACTION COMPANY, capital stock $10,000, has been formed to construct and operate motors, cable and other machinery for supplying motive power to passenger railways. E. S. Perot, H. R. Rhoades and Henry Freedly are the organizers.

THE ELECTRIC EXPERIMENTAL AND DEVELOPING COMPANY, New York City, capital stock $100,000, has been formed to acquire patents to a system of electric lighting and heating. Wm. E. Mandelick, W. B. Vandewater and A. C. Macandrew, 44 Broad street, New York City, are the promoters.

THE AURORA ELECTRIC LIGHT AND POWER COMPANY, Aurora, Mo., capital stock $20,000, has been formed to furnish electricity for lighting streets, houses, and running all kinds of machinery. E. L. Foster, Independence, Kan.; M. T. Davis, W. F. Branham and J. J. Rehm, Aurora, Mo., are the organizers.

THE ROSEBURG ELECTRIC LIGHT AND POWER COMPANY, Seattle, Wash., capital stock $20,000, has been formed to engage in lighting and heating by electricity, also to operate telephones, railways, etc. The promoters are H. E. Clements, W. J. Grambs, Seattle, Wash., and S. Z. Mitchell, Portland, Ore.

THE SCRANTON AND PITTSTON TRACTION COMPANY, Scranton, Pa., capital stock $1,050,000, has been organized to construct and operate motors and cables or other machinery for supplying motive power to passenger railways. W. F. Sadler, Lemuel Amerman and C. H. Mullin are the interested parties.

THE CONSUMERS' ELECTRICAL SUPPLY COMPANY, New York City, capital stock $1,000, has been formed to manufacture and sell electrical supplies. The interested parties are: H. G. Martin, 221 West 133d street; Elbert Brussel, 18 East 133d street, and J. A. Moses, 1037 Fifth avenue, New York City.

THE UNIVERSAL ELECTRIC PULL SOCKET SWITCH COMPANY, New York City, capital stock $20,000, has been formed to manufacture and sell electrical appliances. L. Stirn, 125 East Sixty-ninth street, New York City, and Jno. M. Wellbrock, 695 Quincy street, Brooklyn, N. Y., are among those interested.

THE C. H. BROWN ELECTRIC BATTERY COMPANY, Portland, Ore., capital stock $100,000, has been formed to conduct a general business for supplying light, heat and power by means of electricity. Charles H. Brown, A. P. Armstrong, Thomas Walker, Louis Prager, Charles E. Wilbur, James Posey, Thomas M. Rogers and Thomas R. Demorest, Portland, Ore., are the promoters.

THE E. WALLEY JONES & SONS' COMPANY, Seattle, Wash., capital stock $30,000, has been formed to operate electric light and power plants, and to manufacture stoneware. E. W. Jones, E. J. McKittrick, C. W. Winkley, A. W. Pratt, William Simison, W. W. Dearborn, R. Alm, W. H. Clark, A. Burns, H. Haney, A. Anderson, C. E. West, W. D. Brewster, O. E. Jones, E. Jones, L. A. Jones and P. A. Jones are interested parties.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-176 TIMES BUILDING, NEW YORK, Oct. 2, 1893.

MR. JAMES BRANNEN, treasurer of the Horn, Brannen & Forsyth Manufacturing Company, Philadelphia, Pa., is in Chicago.

THE CONEY ISLAND & BROOKLYN RAILROAD has decided to take up all the track on Smith street and replace it with a new and heavier rail.

THE PENNSYLVANIA RAILROAD COMPANY, it is again rumored, is behind the New Jersey Improvement Company and the Consolidated Traction Company.

F. E. PRITCHARD has resigned his position with the Cayadutta Electric Railway to take charge of the Oswego Electric Light Works and street railway as general manager.

FIFTH AVENUE has two additional arc lamps for each block, the new poles being in the middle of each block. Owing to the large amount of light absorbed by the globes used, the result is again disappointing.

THE BROOKLYN CITY RAILWAY COMPANY has permission from the State Board of Railroad Commissioners to change from horse power to electricity. The permission to use electricity is given subject to the lawful regulations of the local authorities and subject to such restrictions as to speed as the Commissioners may hereafter make.

MR. CHARLES W. MARSH has retired from the Neftel & Marsh Company, engineers and contractors, at 126 Liberty street, New York, and the business is to be continued under the name of Neftel, O'Connor & Co., Incorporated, at the same address. Mr. Knight Neftel is president, Mr. B. F. O'Connor treasurer, and Mr. Stanford Brown, secretary.

IN NEWARK recently the Delaware, Lackawanna & Western Railroad refused to let the electric cars of the new line of the Consolidation Traction Company cross their tracks, barring their passage by keeping the gates closed. Acting under instructions a car was successfully used as a battering ram against the gates with the result that no further obstruction was offered.

RAPID TRANSIT FOR NEW YORK CITY.—We have received from Mr. J. W. Reno a description, in pamphlet form, of his solution of the rapid transit problem in New York City. The Reno system consists of a double-decked tunnel, 22 by 23 ft. in cross section. He claims that the advantages of this form of construction are very great on account of the narrowness of the streets through which the tunnel must of necessity run. The cars are propelled by electric motors. The total cost of the 10½ miles of track from the Battery to Fort George is estimated at $24,650,000. This system was fully described in The Electrical World of June 20, 1891.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 91, Hathaway Building, 620 Atlantic Ave.,
BOSTON, Mass., Sept. 30, 1893.

MR. R. J. MERCUR, representing the New York Car Wheel Works, Buffalo, N. Y., was a recent visitor to the Hub.

THE HAMMOND CLEAT AND INSULATOR COMPANY, Boston, Mass., reports a very good business, considering the times, many of its orders coming from the West.

THE BOSTON CAR WHEEL COMPANY has opened an office at No. 620 Atlantic avenue, Boston, Mass., with Mr. Draper as manager. The company will manufacture street car wheels.

THE PROVIDENCE ELECTRICAL WORKS is the name of a new incorporation which will do business in Providence. It is reported that the company has secured an option on the Daboll Mill buildings, in Elmwood, and will absorb the Consolidated Electrical Manufacturing Company, of Boston, Mass. The capital will be $400,000. It proposes to manufacture dynamos and insulated wire.

THE ELECTRIC GAS LIGHTING COMPANY, Boston, Mass., has passed the following resolutions upon the death of Mr. Louis W. Burnham, the late vice-president and general manager of the company;

Whereas, Louis W. Burnham, vice-president and general manager of the Electric Gas Lighting Company, departed this life Aug. 9, after a brief illness; and

Whereas, the board of directors of the company desire to put on record their high appreciation of their deceased associate, and deep sense of the great loss which the board and the company have sustained; therefore,

Resolved That in the decease of one who has been so constant, so able and so indefatigable in developing and advancing its interests, this corporation has lost an officer whose strength, energy and integrity of character were invaluable; and the board has lost a member for whose manly character his associates entertained a high personal regard, and upon whose aid in their common duties they have long and confidently relied.

Resolved, That the directors hereby tender to the family of their late associate their heartfelt sympathy in this sudden bereavement.

Resolved, That these resolutions be extended upon the records of this corporation, and a copy of the same be sent to the family of the deceased.

WESTERN NOTES.

OREGON CITY, Ore., Sept. 25, 1893.

ST. HELENS, ORE., is negotiating with a view to the installing of an electric lighting plant in the near future.

EVERETT, WASH., has closed a contract with the Everett Railway and Electric Company for 32 arc lights for street lighting at a cost of $11.50 a lamp.

AN ELECTRIC LIGHT ANNEX will be built in connection with the large Union depot now in course of construction in Portland, Ore. The annex will be located at a distance of 45 feet from the main building, thereby reducing the risk of fire. The plant will be a complete one in every way.

THE CITY OF TACOMA, which recently awarded a large contract for arc light carbons to the Northwest General Electric Company, has been enjoined by the courts from carrying out the contract. The suit was brought by Bradney & Morley, of Tacoma, who claim to have put in a lower bid, which was not considered.

THE EAST SIDE RAILWAY COMPANY, of Portland, Ore., is double tracking its line to Oregon City from Abernethy to Moss street. The service between Portland and Oregon City has been reduced to an hourly one, but the suburban car running to Gladstone leaves Oregon City at regular intervals between the trips of the cars to Portland.

CANADIAN NOTES.

OTTAWA, Sept. 27.

OTTAWA, ONT.—A strong effort is being made to have an electric street railway service on Sunday. The question will be voted on shortly.

ST. CATHERINES, ONT.—Application for a charter is being made by the Preston & Berlin Railway Company, with power to construct and operate a system of steam or electric railways in the municipalities of Preston, the township of Waterloo, the village of Hespeler and the towns of Waterloo and Berlin, all in the county of Waterloo, Province of Ontario.

THE CHAUDIERE ELECTRIC LIGHT COMPANY and the Ottawa Electric Company have formed a business amalgamation, to be followed by actual and legal amalgamation as soon as the latter can be consummated. Application for legal amalgamation has been made to the Federal government. Robt. Blackburn is president of the new company and Thomas Ahearn general manager.

CALGARY, N. W. T., is going in for electric light. The tender of the Electric Light, Heat and Power Company was the only one received, and the Council accepted it. The offer of the company is 30 arc lights, 1,200 c. p., at $75 a year each, and private lighting will be given as follows: 10 c. p., 50 cents per month; 16 c. p., 60 cents per month; 32 c. p., $1.10 per month; 50 c. p., $1.50 per month.

HALIFAX, N. S.—The City Clerk is calling for tenders for lighting the streets of the city of Halifax for three years or more with arc lights and incandescent lights, according to the terms and conditions in the form of contract. Tenderers are also invited to submit a tender on their own plan by which, in their opinion, the city may be more efficiently and cheaply lighted than proposed in the form of contract prepared by the Board of Works. Such tenders will receive the same consideration as those submitted on the Board of Works' form of contract.

ENGLISH NOTES.

(*From Our Own Correspondent.*)

LONDON, Sept. 20, 1893.

THE PURCHASE OF THE TELEPHONE TRUNK WIRES.—After considerable hesitation the Postmaster-General has agreed to lay the proposed agreement with the National Telephone Company relative to the purchase of its trunk wires before the House of Commons previous to ratification. This document, however, will not be made public until the House resumes its labors in November. It is to be hoped that the members who have succeeded in bringing about this step will, by November, have evolved a definite alternative policy to that to which the Postmaster-General has been committed by the previous Parliament.

THE BRITISH ASSOCIATION MEETING AT NOTTINGHAM.—There is nothing to be said about the British Association meeting at Nottingham except that so far as concerns the sections devoted to physical and mechanical science, the papers, both in quality and quantity, exhibited a falling off. An interesting exhibit, which was described by Dr. Oliver Lodge, was that of a ballistic galvanometer, specially designed for physiological research. Mr. W. W. Beaumont described in Section G, a new form of variable power gear for electric motors, and also a device for automatically balancing reciprocating mechanism. The other papers in this section were, for the most part, on topics already well worn.

THE TELEPHONE QUESTION.—The Postmaster-General has at last yielded to the demand that the agreement between

the Post Office and the National Telephone Company with regard to the purchase of that company's trunk wires should be laid before Parliament before ratification. It is difficult to see exactly what can be gained by this step. The main lines upon which the agreement was to be drawn up have already been agreed to, and the only detail about which there can now be much difference of opinion is the actual price to be paid for the trunk wires, and even on this point, unless a breach of faith is committed, nothing much can be done, since Parliament agreed that their actual cost to the company should be the basis of the purchase price.

News of the Week.

ELECTRIC LIGHT AND POWER.

EL RENO, OKLA.—The city is discussing the matter of street lighting.

CANNONSBURG, PA.—Messrs. Pare have the contract for erecting an electric light plant.

DANIELSONVILLE CONN., is still discussing the matter of electric street lighting but has reached no decision.

WINCHESTER, MASS.—Residents will soon take action in the matter of the proposed electric lighting plant.

SALISBURY, MD., is to have a new electric light plant. The old one that was burned down last May has never been rebuilt.

PERU, ILL.—The new Turner Hall will be lighted by 500 electric lamps. If is expected it will be in readiness for dedication during the holidays.

BIG RAPIDS, MICH.—The Mecosta Electric Company has been organized with a capital of $25,000, and they will be ready to light the town within a month.

THE ALEXANDRIA (IND.) ELECTRIC LIGHT AND POWER COMPANY contemplates putting in a 1,000-light alternating current machine within a short time.

HILLSBORO, TEX.—A franchise has been granted to J. D. Fredd, Box 385, Fort Worth, to put in an electric plant at Hillsboro. Electric apparatus will be purchased.

MAZOMANIE, WIS.—The Village Board has submitted a proposition to vote on the question of issuing $20,000 in bonds for the purpose of putting in water-works and electric lights.

MINNEAPOLIS, MINN.—Plans and specifications have been prepared for the erection of a $25,000 hospital for the St. Barnabas Hospital Association. The hospital will maintain its own electric light plant. L. R. Robinson is secretary.

NORTH EAST, MD.—There is a strong movement here in favor of the extension of the electric lighting from Havre de Grace to this point. Hughes & Rigby, of Baltimore, have the matter in hand and they will erect the Havre de Grace plant.

CENTREVILLE, HUNTERDON COUNTY, N. J.—Residents are talking of introducing electric street lighting and are conferring with C. E. Crisman to that end. If they fail to negotiate with him they will procure a separate plant.

OLATHE, KAN.—Sealed proposals will be received at the office of the Board of Public Works until Oct. 9 for all the labor and material required in the construction of an electric light plant for the Institution for the Education of the Deaf and Dumb. Wm. Wykes is secretary.

HANOVER, PA.—An amendment has been introduced into Council that if the Hanover Light, Heat and Power Company shall not have introduced the electric lights into at least five of the principal streets before Nov. 1 the ordinance granting them the right shall be null and void.

PAWTUCKET, R. I.—At the monthly meeting of the Board of Aldermen a joint resolution was passed authorizing the joint standing committee on street lights to make a contract for lighting the city for three years, upon such terms and for such price as may seem advantageous to the city.

MORRISTOWN, PA.—Sealed proposals will be received by the Committee on Electric Light Plant for the State Hospital for the Insane at Morristown, Pa., to 3 p. m. Oct. 25 for the erection of an electric lighting plant there. For details address Dr. W. A. Drysdale, No. 20 Hale Building, Philadelphia, Pa.

THE LEROY (ILL.) ELECTRIC LIGHT AND POWER COMPANY has been organized with the following officers: L. A. Crumbaugh, A. A. Keenan, Amos Rutledge, L. A. Reynolds, S. D. Van Deventer and C. A. Buck. The capital stock is $10,000 and the papers have been forwarded for the charter. The company expects to put in an entire new plant, fully equipped to furnish light and power for all purposes.

THE ELECTRIC RAILWAY.

OLNEYVILLE, R. I.—Work has been commenced on the electric railway.

ADRIAN, MICH.—The electric belt railway at Adrian has been sold to a Philadelphia syndicate. The system will be extended.

PROVIDENCE, R. I.—The Union Railroad Company is taking preliminary steps toward equipping the Olneyville route with electricity.

MEMPHIS, TENN.—It is stated that the Citizens' Street Railway will be extended to Montgomery Park. Address Superintendent Jones.

HOBOKEN, N. J.—The North Hudson County Railroad Company is again applying for permission to operate its surface lines by electricity.

ENGLEWOOD, N. J.—The New Jersey "Flying Post," of Jersey City, is moving for an electric railway and electric lighting plant for ths pretty suburb.

KANSAS CITY, MO.—The tracks of the Kansas City electric road will be rebuilt, and the motor cars will be re-constructed. Robert Gillham is president.

LANCASTER, PA.—The Common Council has defeated the ordinance granting right of way through certain streets to the Lancaster Traction Company.

THE COTTAGE CITY (MASS.) STREET RAILWAY is to be extended and equipped electrically. The road is owned and managed by W. A. Boland, 610 Exchange Building, Boston.

THE SHORT ELECTRIC STREET RAILWAY, in Bangkok, Siam, the first electric road in the Orient, was completed in June, and the receipts have already increased 30 per cent.

ASHEVILLE, N. C.—The plant, rolling stock, etc., of the Asheville Street Railway Company has been purchased by the bondholders. The line will be improved by them.

HAVERHILL, MASS.—The Haverhill "Evening Gazette" is authority for the statement that there is a strong movement to build an electric road to Chester, N. H., passing through Plaistow, Atkinson and Hampstead.

WASHINGTON, D. C.—The Washington Central Railway Company is before the District Commissioners with a petition for right of way, and they have taken the matter under consideration before making a report to Congress.

MIDDLETOWN, N. Y.—The Commissioners of the town of Walkill have granted the application of the Middletown & Goshen Traction Company to construct an electric railway through the streets and to use the T rail.

BRISTOL, CONN.—The Bristol & Plainville Tramway Company has been organized, and a survey will be made and application for the right of way laid before the selectmen. H. E. Pierce is president and Chas. S. Treadway is secretary-treasurer.

NEW ROCHELLE, N. Y.—The managers of the Union Trolley Company are making their third attempt to run the trolley through New Rochelle. The taxpayers have just macadamized some of the roads wanted for the line and are opposed to the grant.

EAST DOUGLAS, MASS.—Survey has been made for an electric line from St. Charles Hotel, at Millbury, to East Douglas station and for a loop to start from Manchaug and run through West Sutton, all under direction of Town Committee, appointed last April.

PLAINFIELD, N. J.—A project is under way to build an electric railway between Grant avenue, in Plainfield, and the village of Dunellen, and Jacob Kriney, of Plainfield, has secured the names of 600 persons favoring the plan. The distance is about two miles.

WARREN, PA.—W. M. Lindsay, C. W. Stone, A. J. Hazeltine and Jas. O. Parmlee, all of Warren, are interested in a scheme to improve Celoron, on Lake Chautauqua, and they are making arrangement with Mr. Broadhead to extend his electric road to that point from Jamestown.

OAKLAND, CAL.—W. E. Meek and others have asked the supervisors for a right of way and permission to lay down and operate an electric street railroad, with single or double tracks and turnouts, commencing on the centre of the country road leading from Oakland to San Leandro.

HUGHESVILLE, PA.—The Hughesville "Mail" is authority for the statement that Henry Lenhart, of Philadelphia, Pa., is working upon the matter of an electric railway between Picture Rocks and Muncy, and that he has succeeded in rousing the interest of the citizens of these places.

ATLANTA, GA.—The franchise and equipment of the city railway has been purchased by the Atlanta Traction Company. The new system will extend a distance of nine miles in the city and suburbs. Several connections will be made between the different lines. T. B. Folder, Jr., is president of the new company.

BELAIR, MD.—The Hughes & Rigby Co., of Baltimore, which holds a contract for lighting the streets of Belair by electricity, has sent a representative to inquire into the propriety of building an electric road between Belair and Havre de Grace by the old Deer Creek & Susquehanna route, by way of the Susquehanna River.

YOUNGSTOWN, O.—The city commissioners and others of the committee appointed by President Whitehead to consider the application of the Youngstown Park & Falls Company and the Youngstown & Canfield Electric Railway Company for a franchise, decided to advertise at once for proposals for electric railways over the routes.

WHEELING, W. VA.—A scheme was proposed some time ago to build a suburb east of the Mont de Chantal station. The project has been revived and certain Pittsburgh capitalists have offered to subscribe two-thirds of the capital if Wheeling will subscribe the other one-third. This will likely be done and an electric railway and several bridges will be built.

THE DES MOINES RAPIDS POWER COMPANY, of Hamilton, Ill., organized Sept. 18, capital stock $500,000, has for its object the developing of the water power of the Des Moines Rapids of the Mississippi River for the purpose of transmitting electricity to Keokuk, Ia.; Warsaw, Hamilton and Nauvoo, Ill., for light, heat and power. H. C. Reiner, superintendent and purchasing agent of the Gate City Electric Street Railway, Keokuk, Ia., is one of the promoters, and James Anthony is chief engineer.

CINCINNATI, O.—An ordinance has been draughted which, among other measures, requires that street railway wires shall be electrically tested three times daily and cars once; that all cars shall be provided with a switch and safety fuse, the former to be within easy reach of the motorman, and that every car shall be equipped with an approved air brake and a trolley finder; the ordinance further provides that return circuits must be of the same capacity as feeders, and single trolley systems must be constructed in sections of not more than one mile.

SCHUYLERVILLE, N. Y.—Parties from New York have completed the survey for an electric road to run from Greenwich to Schuylerville by way of Middle Falls, Clark's Mills and Thompson's Mills, crossing the Hudson River at the latter place on piers and abutments already built. Power will be obtained from a dam to be constructed on the Battenkill River between Clark's Mills and a place known as Big Falls, about four miles from Greenwich; it is claimed that a head of 28 feet and plenty of water are obtainable here. Mr. W. Hill and Mr. D. D. Hill, of Greenwich and Keesville, N. Y., are the promoters of the scheme in co-operation with New York parties. It is proposed to furnish light to Schuylerville, Greenwich and other places, and as there are a number of large mills on the proposed route, the freight traffic is counted upon as an important source of revenue.

PERSONAL NOTES.

PROF. W. J. SHIELDS, of the University of Pennsylvania, takes charge of the Department of Electrical Engineering in the University of Vermont this fall.

PROF. GALILEO FERRARIS sailed for Europe on Saturday, Sept. 30. He expressed himself as delighted with his American tour, and regrets that he cannot remain longer in a country he has found so charming.

M. ALEXANDRE DE SMIRNOFF, editor-in-chief of the only electrical journal in Russia, "Electrichestwo," sailed for Europe on Sept. 30, after a visit to the electrical features of New York and vicinity, on his return from the World's Fair.

DR. ADRIEN PALAZ, of Lausanne, Switzerland, one of the Swiss official delegates to the International Electrical Congress, sailed on Sept. 30 on the Bourgogne, his visit to America having been somewhat curtailed by important electrical work requiring his attention in Europe.

PROF. VON HELMHOLTZ will be tendered a reception on Tuesday evening, Oct. 3, by President and Mrs. Low, in the Library of Columbia College. This will be attended by the trustees, professors and other officers of the University, as well as by numerous invited guests. Prof. von Helmholtz will also address the students of the University on Thursday afternoon, when they will gather to hear him in the large lecture room of the Law School building. The Century Club will give a reception to Prof. von Helmholtz on Wednesday evening.

MR. GILBERT WILKES has estabfished himself as a consulting electrical engineer in Detroit. Mr. Wilkes is an unusually well qualified electrical engineer from his wide experience in different branches of electrical work. Graduated from the United States Naval Academy and the electrical course at Johns Hopkins University he has in turn been a naval inspector of electric lighting, chief inspector and district engineer in the former Edison companies, and more recently chief engineer of the Detroit Electrical Works. Those who know how creditably he has performed his duties in the various positions held by him feel that in his new career his competency will bring new successes.

MISCELLANEOUS NOTES.

THE NATIONAL SOCIETY OF ELECTRO-THERAPEUTICS held its annual meeting at the Berkeley Lyceum, in West Forty-fourth street, New York, on Sept. 29 and 30. A large number of papers was read.

THE FIRE UNDERWRITERS' ASSOCIATION of the Northwest held its twenty-fourth annual meeting in Chicago, commencing Sept. 27. President Harbeck delivered an address and a number of papers was read.

THE SCHUYLER ELECTRIC COMPANY has denied the reports that its works will be transferred to Lynn, Mass. The officers of the company expect to start up the factory as soon as times get better, and they hope that will be soon.

ELECTRIC CANAL BOATS.—Frank W. Hawley, of Pittsford, N. Y., vice-president of the Cataract Electric Company, has been granted permission to make experiments with electric boats equipped with the Westinghouse system. The tests will be made on the Erie Canal near Mr. Hawley's Pittsford farms.

ELECTRIC AMBULANCES AND HEARSES.—San Francisco has an electric street railway hearse on the line to Cypress Lawn Cemetery, and the St. Louis city authorities have decided to build one or several electrical ambulances, the various electric lines having consented to allow the free use of their roads to these.

THE GENERAL ELECTRIC COMPANY has, it is reported, made a 10 per cent. reduction of wages at the Lynn works, affecting only the workmen who have been re-employed since Monday, and officials and foremen drawing salaries of more than $1,000. The cut will take effect on Oct. 1, and continue to Jan. 1, and applies also to the salaried men in the employ of the General Electric in Schenectady and other manufacturing places, and in the New York and branch offices, purchasing and commercial departments. About 300 employees have been taken on at the reduced rates. They have been out of work some time, and made little objection to the reduction.

CALIFORNIA MIDWINTER INTERNATIONAL EXPOSITION.—M. H. De Young and other prominent gentlemen from the Pacific slope have organized to produce a midwinter exposition at Golden Gate Park, San Francisco, to which it is expected many of the interesting exhibits of the World's Fair will be transferred. The types and styles of architecture on which the designs for the buildings are prepared deviate entirely from a style now somewhat overdone, and the edifices that will adorn the site of the Exposition in Golden Gate Park are intended to be especially Oriental, or Moorish, Aztec, early Spanish Mission, etc. The heights of facades will be embellished with ornaments made of staff, will measure from ground to roof 40 feet and from top of foundation to eaves 50 feet. The architectural centre will be the Tower of Concert Valley. This is to be 262 feet in height, extremely graceful in its lines and suited to the most elaborate decoration. The prime object of the tower is to furnish facilities for lighting and curious electrical display. It will also be utilized as a grand music stand, in which bands will play constantly during the day. Four Moorish pavilions 60 feet high will flank the open space, each containing four stories and decorated with the greatest elegance. On the second floors of the tower will be four chambers, two for bands, and the other two for a resting place for visitors. The third and fourth floors of the tower will be open to the public, affording a most magnificent view of the Exposition and the city. The music stand, which forms the foundation of the tower, is in a sort of basin, serving admirably as an amphitheatre; at each of the four corners is a cascade, and on each side is a restaurant. The whole is approached by eight stairways. At night the beautiful colored, ever-changing lights of the electric tower will brighten the cascades and illuminate the grounds. Another prominent feature of the Exposition will be a great allegorical fountain, forming an apotheosis of the architectural, sculptural and aquatic. Opposite this will be the Manufactures Building, and at its right corner south the Fine Arts Building. On the north is the Administration Building, on the diagonal will be the Machinery Hall, and on the opposite diagonal will be the Horticultural and Agricultural Building. All of these structures are so located as to allow the eye a methodical view, but the mathematical stiffness is completely obviated by the landscape effects. Near the entrance inside the grounds will be a subterranean place, out of which will extend grottos. In the cavern the operations of gold and silver mining will be shown. At the end of the underground cave will be an aquarium stocked with fish of all kinds. The material used in construction will consist of the different geological rudiments of the country itself. Scattered here and there about the grounds will be thirty or more small buildings, each containing a special attraction, for which concessions will be given.

Trade and Industrial Notes.

THE STANLEY ELECTRIC MANUFACTURING COMPANY, Pittsfield, Mass., will begin the manufacture of generators.

MR. W. B. ROBERTS, formerly general manager of the Rockford Electric Manufacturing Company, of Rockford, Ill., has severed his connection with that company, and is now acting as general agent for the Muncie Electrical Works, of Muncie, Ind.

THE POST-GLOVER ELECTRIC COMPANY, of Cincinnati, O., has gone into the manufacture of street railway equipments and supplies in addition to its general electrical business, and is doing so much with street railways as to enlarge its business considerably.

THE GENERAL INCANDESCENT ARC LIGHT COMPANY, 572 First avenue, New York, has issued circulars Nos. 3, 4 and 5, devoted to illustrations and price lists of incandescent arc lamps, including their new railway circuit arcs, and also a price list of arc carbons.

DOUBLEDAY, MITCHELL & CO., 136 Liberty street, New York, report the sales of the flexible conduit tubing, manufactured by the American Circular Loom Company, Boston, for whom they are New York agents, as very gratifying during the past few weeks, evidencing the improvement in general condition of business.

DR. W. F. HOWE, of Potsdam, N. Y., and D. G. Cahoon, of the High Falls Sulphite Paper Company, have formed a partnership under the name of the Dr. Howe Manufacturing Company, and they will make and sell the electro-thermal and vapor bath apparatus invented by the doctor. They will soon build a plant at Potsdam.

QUEEN & CO., Philadelphia, recently secured an order for the testing outfit to be used by the Philadelphia Traction Company in its new power house at Thirteenth and Mt. Vernon streets. This is a very satisfactory testimonial for the Queen apparatus, as a similar contract was executed between the same parties last year.

THE DAHL ELECTRIC COMPANY, of 120 Liberty street, N. Y., is having an active demand for its alternating arc lamp. The arc in this lamp burns particularly steady and noiseless, and the general appearance of the lamp is pleasing. The demand for the company's alternating current power motors from 1 to 10 h. p. continues active, and a considerable demand for export is noted.

THE JEROME KIDDER MANUFACTURING COMPANY, 820 Broadway, New York, has issued in pamphlet form a Columbian year souvenir presenting a large number of unsolicited testimonials as to the merits of the batteries and other pieces of apparatus manufactured by this well known firm. These are only a few of the testimonials which the company has received during the Columbian year.

CUTLER & HAMMER, 313 South Canal street, Chicago, Ill., in order to supply the demand for their high-grade electrical specialties and contract work, have found it necessary to greatly increase their capacity and have purchased the factory of the Chicago Electric Manufacturing Company, 241-247 South Jefferson street, Chicago, which they will operate as the Cutler-Hammer Manufacturing Company. They have excellent facilities, and with their long experience in this line they will be able to sustain their reputation for first class electrical work.

THE NEW FRISBIE ELEVATOR in the car house of the Consolidated Street Railway Company, Worcester, Mass., is said to be the largest electric elevator ever built in the United States. It consists of a platform 34 feet long, 15 feet high and 10 feet wide, weighing 6¼ tons, and is capable of lifting a maximum weight of nine tons. The steel beams which carry the sheave wheels, weigh, with their supporting columns, more than four tons. The motive power for this elevator is supplied by a 20-h. p. electric motor of the Westinghouse type, which derives its power from the trolley circuit. The railway company will use the elevator for lifting their cars from the ground floor to the second story of their building whenever storage or repairs are desirable.

RIEHLE BROS. TESTING MACHINE COMPANY, Philadelphia, reports indications of an improvement in business, and considers permanent prosperity near at hand, as soon as legislation at Washington reaches some definite policy. Among the recent orders it reports the following: 20,000-pound horizontal testing machine, 10,000-pound vertical screw power testing machine, canvas testing machine for the U. S. Government, warehouse and railroad trucks for export, 3,000-pound transverse testing machine, 1,000-pound cement testing machine with worm gear, "Star" cement testing machine, 40,000-pound screw power testing machine, two 1,000-pound cement testing machines, 100,000-pound testing machine, six 20-ton Riehle-Robie protected ball bearing screwjacks.

Business Notices.

BATTERY CUT-OUT, CHEAP.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse, N. Y.

DESK ROOM in the commodious office of The Electrical World, in the new Monadnock Block, Chicago, may be obtained by applying in person or by letter to the office, 936 Monadnock Block.

OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

UNITED STATES PATENTS ISSUED SEPT. 19, 1893.

(IN CHARGE OF W.A. ROSENBAUM, 177 TIMES BLDG., N.Y.)

505,087. TELEPHONE; J. B. S. Booth and E. J. Falconer, Manchester, Eng. Application filed Jan. 31, 1893. In an electric telephone, a single diaphragm arranged perpendicular to and between two co-axial pole-pieces of a permanent or an electro-magnet, the pole pieces having thereon coils included in the line circuit and wound or joined in such a manner that the line current tends to produce similar polarity in the ends of the pole pieces next to the diaphragm.

505,097. ELECTRIC LIGHT FIXTURE; B. F. Flint, Cincinnati, O. Application filed June 17, 1893. A revolving shaft, provided with a number of electric lights and freely suspended by bands that conduct the current to said lights.

505,098. REVOLVING ELECTRIC LIGHT; B. F. Flint, Cincinnati, O. Application filed July 5, 1893. The combination of an illuminating device, of a revolving shaft carrying electric lights, wires that conduct the currents to said lights, and obliquely arranged blades, which latter turn said shaft when struck by a current of air.

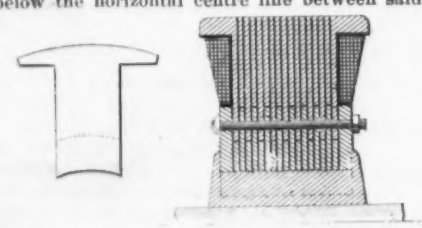
505,106. LIGHTNING ROD; N. D. C. Hodges, Plainfield, N. J. Application filed Dec. 17, 1890. A lightning rod provided with one or more deflagrating sections adapted to be destroyed by the passage of a discharge of lightning.

505,123. INSULATOR PIN; J. J. O'Neill, Boston, Mass. Application filed April 14, 1893. As an improved article of manufacture, a composite supporting pin for electric conductors or wires, consisting of a non-metallic portion and a reinforcing metal portion.

505,125. PROCESS OF MANUFACTURING ELECTRODES; C. Pollak, Frankfort-on-the-Main, Germany. Application filed April 19, 1893. The process of producing electrodes for electrical accumulators which consists in mixing pulverized carbonate of lead with caustic soda or caustic potash so as to form a paste, then forming the same into suitable shape or form, then drying the same, then placing the same in an alkaline bath and applying an electric current to reduce the carbonate of lead to metallic lead, and then compressing the same while still in a wet state.

505,170. TELEPHONE SWITCH; T. W. Ness, Montreal, Canada. Application filed May 22, 1893. The combination with the key board of a warehouse or local telephone system, the independent switch key thereof, and the telephone hook mechanism, an automatic return for such key or switch under the control of said telephone hook mechanism.

505,183. ELECTRIC ARC LAMP; A. S. Atwater, Cleveland, O. Application filed Jan. 16, 1893. In an arc lamp, the combination of flat carbon candle plates having linear edges presented to one another for the formation of the arc, a stationary holder for the lower carbon, and an oscillating upper holder whose fulcrum point is located upon the lower holder at a point below the horizontal centre line between said holders.



No. 505,247.—ARMATURE FOR DYNAMO-ELECTRIC MACHINES OR MOTORS.

505,184. DYNAMO-ELECTRIC MACHINE; A. S. Atwater, Cleveland, O. Application filed Jan. 16, 1893. In a dynamo machine, the combination of a ventilated armature, a single coarse wire coil about the armature, having its terminals in collecting rings upon the main shaft, a shunt field exciting coil connecting the terminals of the coarse wire coil and the sections of a duplex commutator, a field circuit having its terminals in radial brushes engaging the said sections and a rheostat in said field circuit provided with an automatic cut-out whereby the rheostat is cut out of the circuit until a normal current has been generated.

505,188. MULTIPLE SWITCHBOARD APPARATUS; J. J. Carty, New York, N. Y. Application filed Feb. 2, 1889. The telephone lines connected together at the central office through one strand of a pair of cords in combination with the cut-off portions of said lines connected together through another strand of the cords, said strand being connected to the ground, whereby the cut-off portions of the lines are grounded and the talking circuits cut off from the source of the test current.

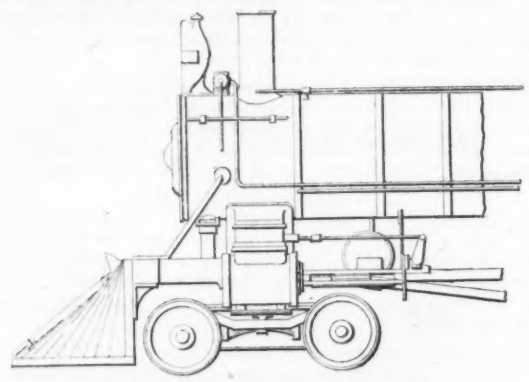
505,200. INDICATOR MECHANISM FOR TYPE SETTING MACHINERY; J. Hooker, Beccles, England. Application filed Jan. 16, 1893. The combination of electromagnets, armatures on axes, arms on these axes, wires connecting these arms to plates having inclines on them, springs drawing the plates in a direction to hold the armatures away from the magnet poles—stops to limit the movement of the plates—vertical slide drawn downward to rest on the inclines of the plates, pawls carried by the slide, slide with racks of ratchet teeth upon it, soft roller pressed against the racks and indicator hand moving with the slide.

505,204. CURRENT CONVEYOR FOR ELECTRIC RAILWAYS; W. Lawrence, New York, N. Y. Application filed Aug. 17, 1892. A contact plate formed in parts, fitted one against the other, insulating material around said parts, a casing binding said parts together, and contacts connected with one of said parts.

505,207. AUTOMATIC REGULATOR FOR DYNAMO-ELECTRIC MACHINES; O. P. Philbrick, Somerville, Mass. Application filed April 2, 1892. In a dynamo, a brake adapted to be operated by solenoids and a spring, in combination with wheels arranged and adapted to change the position of the commutator relatively to the armature, by means of a train of gears connecting said wheels with the commutator.

505,215. CLEAT FOR HOLDING A PLURALITY OF INSULATED ELECTRIC WIRES; E. W. Buffington, Fall River, Mass. Application filed March 27, 1893. In a cleat for holding a plurality of insulated electric wires, the combination with the cleat or cap proper provided with grooves for receiving the wires, of a base having its under surface formed into longitudinal continuous grooves, said cap and base being provided with coincident openings for the reception of screws for clamping the wires between them.

505,233. ELECTRIC ARC LAMP; C. Schmid, Chicago, Ill. Application filed Jan. 10, 1893. In an electric arc lamp, the combination with the carbon and its retaining clamps of a mechanical suspender therefor having a projecting detent, and the intermittent mechanical trip-feed device provided with a ratchet engaging said detent.



No. 505,351.—ELECTRIC HEADLIGHT.

505,241. ELECTRIC LIGHTING SYSTEM; A. G. Waterhouse, Hartford, Conn. Application filed Nov. 23, 1893. An automatic rheostat consisting of working magnets and a swinging contact lever, having a parallel motion of the contacting end.

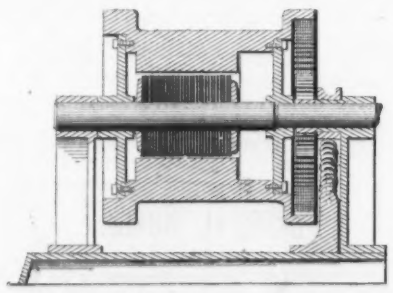
505,243. RECORDING VOLTMETER; W. H. Bristol, Hoboken, N. J. Application filed April 17, 1893. In an electrical measuring instrument, the combination of a stationary solenoid, a movable solenoid provided with metallic portions on its opposite sides insulated from each other and forming the electrical terminals of the same, and flexible metallic supports in electrical connection with the metallic portions of the movable solenoid.

505,247. ARMATURE FOR DYNAMO-ELECTRIC MACHINES OR MOTORS; W. T. Kosinski, New York, N. Y. Application filed May 5, 1893. An armature for dynamo-electric machines and motors, consisting of a laminated ring or cylinder having annular rings in its periphery, in combination with a series of removable radial cores each carrying a coil, said cores being built up of plates which alternately project into the grooves of the cylinder. (See illustration.)

505,263. ELECTRICAL METAL WORKING; G. D. Burton, Boston, Mass., and E. E. Angell, Somerville, Mass. Application filed Feb. 27, 1892. The method of heating a bar of metal of different sizes in cross section, which consists of adjusting the bar on electrodes so as to secure a large area of contact until the larger portion is sufficiently heated, and then gradually reducing the contact of the smaller portion.

505,270. ELECTRIC DOOR OPERATING APPARATUS; O. H. Hicks and R. F. Troy, Chicago, Ill. Application filed May 15, 1893. In combination with a door, motor-mechanism, and a contact plate on the door having an electrical connection with the motor mechanism and operating, by pressure against the plate, to set in motion the motor-mechanism to operate the door.

505,271. ELECTRIC DOOR OPERATING APPARATUS; O. H. Hicks and R. F. Troy, Chicago, Ill. Application filed May 15, 1893. In combination with a door, motor mechanism, and a projection extending, in a plane above the threshold, into the path of the approach of the door and having an electrical contact with motor mechanism actuated by pressure against the projection to set in motion the motor mechanism to operate the door.



No. 505,396.—ELECTRIC MOTOR.

505,293. PRINTING TELEGRAPH FOR CASH RECORDING SYSTEMS; H. K. Hess, Syracuse, N. Y. Application filed Sept. 5, 1892. The combination of a record ribbon, mechanism for feeding the ribbon, a series of independently moving drawers or operating pieces, connections between the ribbon feeding mechanism and operating pieces, whereby one of said drawers and the feeding mechanism move simultaneously.

505,308. TELEPHONE SYSTEM; W. W. Davis, California, Mo. Application filed Dec. 30, 1892. In a telephone system, the combination with a main line and its battery, of a series of magnets inserted therein, a step-by-step mechanism, whose escapement is controlled by the armature of said magnets, power driven mechanism for breaking the main line circuit, and a local circuit comprising two parallel branches, one of which branches is controlled by the movement of the escapement mechanism, and the other by the movement of the said power driven mechanism.

505,346. ELECTRIC ILLUMINATED SIGN; H. A. Bierley, Lexington, Ky. Application filed Feb. 8, 1893. In an electrical illuminating sign the combination with the casing having a series of compartments, with an incandescent lamp in each compartment, and a transparent front having letters thereon, the lamps operated by a continuously rotating cylinder.

505,351. ELECTRIC HEADLIGHT; E. A. Edwards, Cincinnati, O. Application filed Aug. 15, 1893. In an electric lamp, the combination with a case, of the parallel carbons, the incandescent material between the carbons, and a differential solenoid connected to the lighter for automatically establishing the arc. (See illustration.)

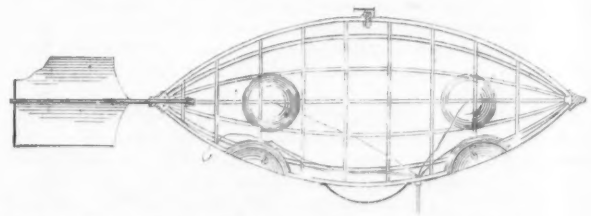
505,370. ELECTRIC RAILWAY TROLLEY; E. R. Robinson, Nashville, Tenn. Application filed March 7, 1893. A trolley wheel constructed with a centrally grooved tread and broad supplementary flanged treads at the sides of the grooved tread for receiving the wire when the wheel's axis is not at right angles thereto.

505,379. MACHINE FOR COVERING WIRES; J. A. Barrett, Brooklyn, N. Y. Application filed March 29, 1892. The combination with mechanism for advancing a plurality of wires and covering therefor, and holding the wires at a fixed distance apart, of a folder for folding a wrapper strip about the wires, and means for securing the layers of said wrapper together between the wires.

505,380. MACHINE FOR COVERING WIRE; J. A. Barrett, Brooklyn, N. Y. Application filed Oct. 27, 1892. The combination with feeding devices for advancing a plurality of wires and a previously gummed wrapper strip inclosing said wires, of a steam chest and perforated guide in said chest.

505,383. ELECTRIC ARC LAMP; S. Bergmann, New York, N. Y. Application filed July 19, 1893. In an electric arc lamp, the combination of the guide frame provided with a weighted catch, and a switch rod provided with a projection with which said catch co-operates to lift the switch rod.

505,392. ELECTRIC PRIMARY BATTERY; T. Coad, London, Eng. Application filed Nov. 10, 1892. A primary battery consisting of suitable cells, carbons secured in each cell electrically connected, the zinc formed with shoulder or projecties for it to be hung by in cell, a recess to secure the zinc between the carbons and a contact point arranged at bottom of recess electrically connected to the carbons of the next cell for one of the projections of the zinc to rest upon.



No. 505,414.—BALLOON FOR OBSERVING DISTANT OBJECTS.

505,393. ELECTRO-MEDICAL AIR INJECTOR; J. Dawdy and F. M. Cattern, Denver, Colo. Application filed Aug. 7, 1893. An electrical apparatus consisting of a tube having a nozzle at each extremity, and a voltaic battery attached to the tube, and conductors passing therefrom through the tube and exposed at the opening in one of the nozzles, whereby the circuit is normally open, but closed by contact with the parts to which the instrument is applied.

505,396. ELECTRIC MOTOR; E. R. Esmond, New York, N. Y. Application filed Aug. 15, 1893. The intermediate and its pendulous spring or weight controlled carrier, in combination with the rotatable field and rotatable armature of an electric motor. (See illustration.)

505,414. BALLOON FOR OBSERVING DISTANT OBJECTS; C. A. Smith, San Francisco, Cal. Application filed May 11, 1893. The combination with a hollow balloon provided with lamps and reflectors, of a tubular rudder stem and the rudder, the stem being provided within the balloon with a valve opening inward. (See illustration.)

505,419. BLOCK SIGNAL APPARATUS; J. H. Frischen, Berlin, Germany. Application filed April 13, 1893. A block signal apparatus comprising a stop rod, formed of three independently movable aligned parts placed end to end, a signal operating lever adapted to be locked by or through the agency of the stop rod, and mechanically or electrically operated latch devices to which the top rod sections are adapted.

505,420. BLOCK SIGNAL APPARATUS; J. H. Frischen, Berlin, Germany. Application filed May 18, 1893. The combination with a signal lever having notches, and one or more projections of a pawl, a stop rod section having a pin, a stirrup, a spring therefor, a rod having a pin, and a duplex lower device.

505,422. ELECTRIC LAMP SOCKET; J. M. Gardner, Jr., Pittsburgh, Pa. Application filed July 1, 1893. A socket for electric lamps having an ejector arranged to force the lamp from the socket.

Copies of the specifications and drawings complete of any patent mentioned in this record—or of any other patent issued since 1836—can be had for 25 cents. Give date and number of patent desired and address The W. J. Johnston Co., Ltd., Times Building, N. Y.